TM 11-5820-758-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL

DS, GS, AND DEPOT MAINTENANCE MANUAL

RADIO SET AN/MRC-114(V)1 THROUGH AN/MRC-114(V)6

HEADQUARTERS, DEPARTMENT OF THE ARMY

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TECHNICAL MANUAL
No. 11–5820–758–15

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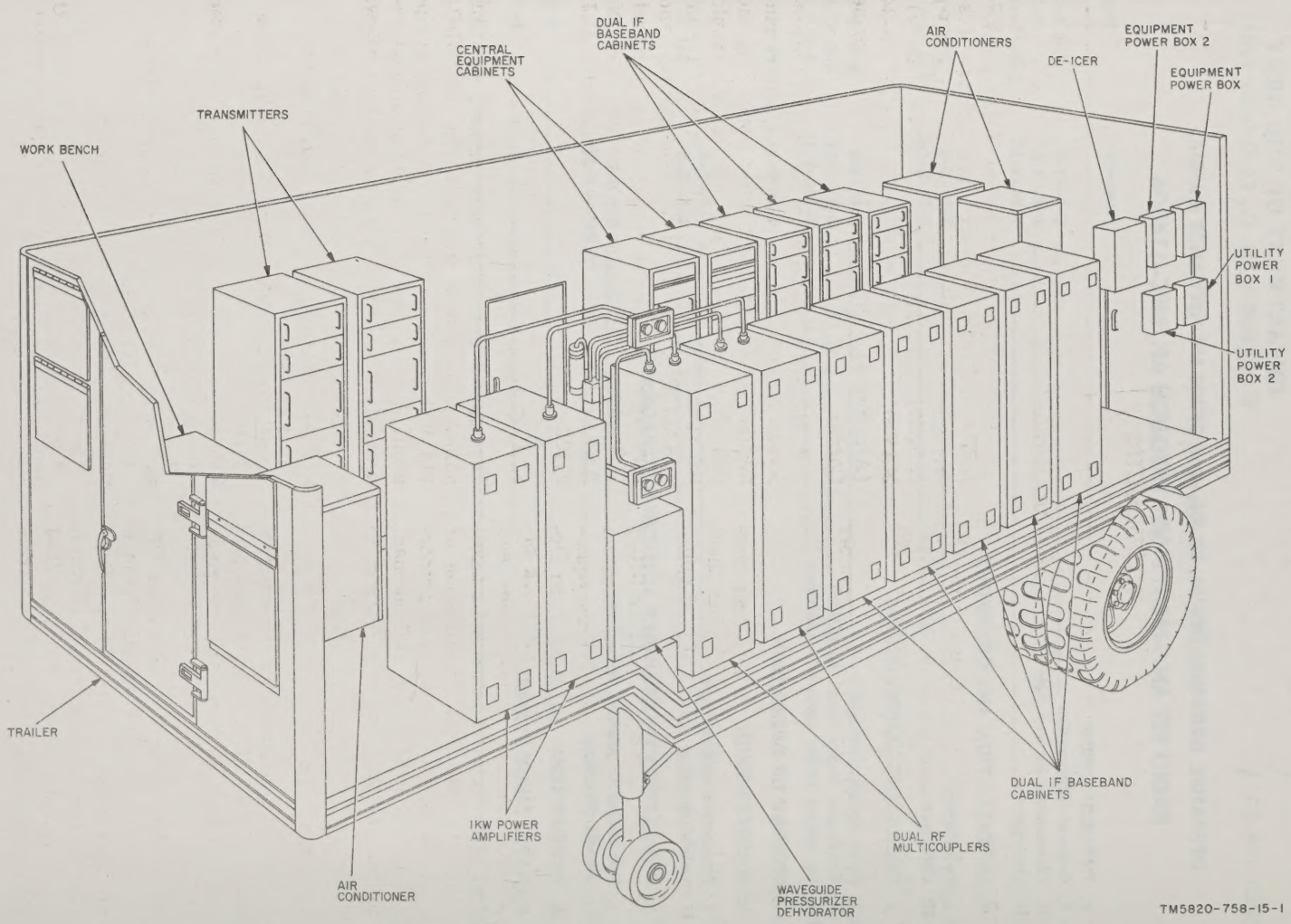


Figure 1-1. Typical Radio Set AN/MRC-114(V)1 through AN/MRC-114(V)6.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Scope

a. This manual contains information for the installation, operation, calibration, and checkout of Radio Set AN/MRC-114(V)1 through AN/MRC-114(V)6.

b. Appendix B is current as of 3 September 1968.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment. DA Pam 310-7 lists all authorized Department of the Army modification work orders, identifying the type, model, series, and Federal Stock Number of the item to be modified; the number, date, and classification of the MWO; the category of maintenance authorized to perform the modification; and the manhours required to apply the modification to each item.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions given in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Publication 378 (Navy), AFR 71-4 (Air Force), and MCO P4610-5 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34 (Air Force), and MCO P4610. 19 (Marine Corps).

d. Report of Equipment Manual Improvements. Report of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-ME-NMP-CT, Fort Monmouth, N.J. 07703.

1-4. Common Names

Throughout this technical manual, common names will be used for Radio Set AN/MRC-114(V)1 through 6 and constituent equipment. A list of cross referencing official nomenclature and common names is given below.

Nomenclature	Common name
Radio Set AN/MRC-114 (V)1 through 6	Nodal point radio set
Trailer, Van V-389/MRC-114(V)	Nodal point radio set van
Maintenance Control Group AN/GSA-99(V) 1 through 12.	Maintenance control center
Radio Equipment Shelter ET-A type NUS 6060.	Radio equipment shelter
Multiplexer Set AN/FCC-40 through AN/FCC-54.	Multiplexer set
Switching Set, Communications AN/MSQ-74 (V)1 through 10.	Console remote equipment

Nomenclature	Common name
Center, Communications Operations AN/MSQ-76 (V)1 through 3 and AN/GSQ–106(V)1 through 3.	Console local equipment
Console, Communication Control OA–8149/MRC–114(V), OA–8150/MRC–114(V), OA–8151/MRC–114(V), OA–8152/MRC–114(V), or OA–8153/MRC–114(V).	Central equipment cabinet A
Console, Communication Control OA–8154/MRC–114(V).	Central equipment cabinet B
Amplifier-Power Supply AM–4419/GRC	1-kw power amplifier
Control-Alarm C–8038/MRC–114(V), C–8039/MRC–114(V), C–8040/MRC–114(V) C–8041/MRC–114(V), or C–8042/MRC–114(V).	Deicer monitor
Control-Alarm C–6768/GRC	Vswr monitor

1–5. Related Publications

Related publications or publications referenced in this manual are given in the following list. All preliminary operating and maintenance manuals (POMM's) referenced in this manual will be replaced by technical manuals (TM's) bearing the same identification number. These POMM's are not available through AG publication channels.

Equipment	POMM number
Maintenance Control Group AN/GSA–99(V)1 through AN/GSA–99(V)12.	11–5820–570–15
Operator's Manual, for Center, Communications Operations AN/MSQ–76(V)1 through AN/MSQ–76(V)3 and AN/GSQ–106(V)1 through AN/GSQ–106(V)3.	11–5820–571–15
Radio Equipment Shelter ET-A Type NUS 6060.	11–5820–572–15
Multiplexer Set AN/FCC–40 through AN/FCC–54.	11–5820–573–15
Nodal Point Receiver, ET-A Types NUS 8021/8024.	11–5820–574–15
Console, Communication Control OA–8149/MRC–114(V) through OA–8154/MRC–114(V)	11–5820–575–15
Console Training Facility ET-A Type NUS 8423.	11–5820–576–15
Switching Set, Communications AN/MSQ–74(V)1 through MSQ–74(V)10 and MSQ–74 (V)12 (console remote equipment).	11–5820–577–15
Center, Communications Operations AN/MSQ–76(V)1 through MSQ–76(V)3 and AN/GSQ–106(V)1 through GSQ–106(V)3 (console local equipment).	11–5820–578–15
Telephone Termination Unit, ET-A Type NUS 6052	11–5820–578–15–1
Power Amplifier Group AN/MRA–15	11–5820–579–15
Electronic Tube Cooler ET-A Type 15–27–32.5	11–5820–579–15–1
1 KW Power Amplifier, ET–A Type NUS 6061	11–5820–580–15
Transmitter, ET-A Type NUS 5951	11–5820–581–15
Communication Control Console OA–7695/GRC and OA–7696/GRC	11–5820–582–15
Dual Receiver, ET-A Type NUS 5961	11–5820–583–15
Operator's Manual, Tributary Terminal Set ET–A Type 5957	11–5820–584–15
Maintenance Control Group AN/GSA–100	11–5820–585–15
Tributary Terminal Set, ET-A Type 7957	11–5820–587–15
Multiplex equipment	11–5820–589–35
Amplifier-Power Supply AM–4419/GRC	11–5820–603–15
ET-A Mainline Site	11–5895–376–15–1
ET-A Tributary Site	11–5895–376–15–2
ET-A Site Equipment Towers and Antennas	11–5859–376–15–3
Test Facilities Kit MK-884/FRC–81( )	11–6625–647–15
Air Conditioner, Model MAC 6V20	TM 5–4120–222–15
Command Control Console System	TM 11–5895–686–12

Section II. CHARACTERISTICS AND DATA

1-6. Purpose and Use

Nodal point radio sets (fig. 1-1) connect remotely located military installations (tributary sites) to other remotely located military installations and up to six command locations served by the main line of communications in the European Tropospheric Scatter-Army (ET-A) network. The nodal point radio sets, located at mainline nodal point sites, each serve a sector of tributary sites in the nodal-to-tributary-site direction. Up to eight tributary sites can compose a sector. This permits the use of a single radiofrequency (rf) carrier frequency for the transmission of the command audio and digital data signals to all tributary sites in the associated sector. Separate carriers are used in the tributary-to-nodal-site direction. Either tropospheric scatter or line-of-sight transmission may be used for the radio links between the nodal point sites and the tributary sites.

1-7. Nodal Point Radio Set Configurations

Because of differences in the number of tributary sites being served and differences in distances and terrain characteristics between nodal point radio set van configurations are used. The configurations and their specific use in the ET-A system and the basic equipment complement for each van configuration are given in paragraph 1-8.

1-8. Technical Characteristics

a. Pertinent Electrical Characteristics.

Frequency range ---------- 4.4 to 5.0 gHz
Multiplex channel capacities used for tributary access links. ---------- 1 and 2 channels
Modulation type ---------- Frequency modulation
Modes of operation ---------- Line-of-sight (LOS); Forward propagation tropospheric scatter; obstacle path diffraction.
Frequency stability (single channel). ---------- ±0.0001% variation
Transmit output power ---------- 1 watt, 1 kilowatt as required.
Diversity:
  LOS hops ---------- Dual space diversity
  Tropo hops ---------- Four-fold space diversity
Antenna system:
  Diameter ---------- 4, 6, 15, or 30 feet
  Polarization ---------- Dual (horizontal and vertical)
  Vswr ---------- Less than 1.2
Decoupling ---------- 40 db
Power handling ---------- 1 or 10 db
Minor lobes ---------- -20 db with respect to main lobe

Planewave gain and one-half power beamwidth at 4,700 MHz:

Antenna diameter	Gain	One-half beamwidth
30 feet	50 db min	0.56°, max
15 feet	44 db min	1.05°, max
6 feet	36 db min	2.7°, max
4 feet	32 db min	3.90°, max

Orderwire facilities:
  Channel wides ---------- 300 to 3,000 Hz
  Signaling frequency ---------- 1,600 Hz
  Radio pilot tone ---------- 4 kHz

Carrier channel facilities (Nodal point to tributary). ---------- 7 kHz to 9.7 khz, second voice communication channel
Carrier channel output level ---------- -17 dbm
Remote order wire input level ---------- -7 dbm
Remote order wire output level ---------- -7 dbm
External operating temperature ---------- -25° C to +45° C
Maximum Operating altitude ---------- 10,000 feet

b. Nodal Point Radio Set Configurations.

Site No.	Qty of vans at site	Radio Set	Tributary Capacity	Power	Parametric amplifiers	Tributary sites served
Spare van	1	AN/MRC-114(V)5 NUS 6260G25	2	1 kw	Yes	Two tributary sites
7	1	AN/MRC-114(V)3 NUS 6260G13	5	1 kw	Yes	Sector 1 — 17, 18, 105, 115
8.1	2	AN/MRC-114(V)2 NUS 6260G5	7	1 kw	Yes	Sector 1 — 30, 39, 54, 90, 97, 106
		AN/MRC-114(V)2 NUS 6260G5	7	1 kw	Yes	Sector 2 — 20, 22, 23, 32, 85, 89
9.1	1	AN/MRC-114(V)2 NUS 6260G5	7	1 kw	Yes	Sector 2 — 31, 70, 110
11	1	AN/MRC-114(V)3 NUS 6260G13	5	1 kw	Yes	Sector 1 — 34, 36, 137, 140
11.1	1	AN/FRC-113(V)2[a] NUS 6060G16		1 kw	Yes	Sector 3 — 109
50.1	1	AN/MRC-114(V)4 NUS 6260G22	3	1 kw	No	Sector 1 — 78, 125
51.1	2	AN/MRC/114(V)1 NUS 6260G1	8	1 kw	Yes	Sector 1 — 16, 25, 41, 51, 81, 88, 95, 139
		AN/MRC-114(V)1 NUS 6260G1	8	1 kw	Yes	Sector 2 — 28, 56, 72, 73, 75, 82, 87
52	1	AN/MRC-114(V)2 NUS 6260G5	7	1 kw	Yes	Sector 1 — 67, 80 91, 93, 94, 111.1, 123

[a]Mainline Site Radio Equipment Shelter; nodal point set van is not used at site 11.1 since only one tributary site is involved.

c. Basic Equipment Supplied.

Equipment name	Radio Set AN/MRC-114(V)1	AN/MRC-114(V)2	AN/MRC-114(V)3	AN/MRC-114(V)4	AN/MRC-114(V)5	AN/MRC-114(V)6
Console, Communication Control OA-8149/MRC-114(V)	1					
Console, Communication Control OA-8150/MRC-114(V)		1				
Console, Communication Control OA-8151/MRC-114(V)			1			
Console, Communication Control OA-8152/MRC-114(V)				1		1
Console, Communication Control OA-8153/MRC-114(V)					1	
Console, Communication Control OA-8154/MRC-114(V)	1	1	1	1	1	1
Transmitter ITTFL NUS 5951-3	1	1	1	1	1	
Transmitter ITTFL NUS 5951-7	1	1	1	1	1	
Transmitter ITTFL NUS 5951-21						1
Transmitter ITTF NUS 5951-25						1
Amplifier-Power Supply AM-4419/GRC	2	2	2	2	2	
Dual RF Multicoupler ITTFL NUS 8021G1	2					
Dual RF Multicoupler ITTFL NUS 8021G3			2			
Dual RF Multicoupler ITTFL NUS 8021G7				2		
Dual RF Multicoupler ITTFL NUS 8021G12				2		2
Dual RF Multicoupler ITTFL NUS 8021G13					2	
Dual IF Baseband ITTFL NUS	8	7	5	3	2	3
Control-Alarm C-8038/MRC-114(V)	1					
Control-Alarm C-8039/MRC-114(V)		1				
Control-Alarm C-8040/MRC-114(V)			1			
Control-Alarm C-8041/MRC-114(V)				1		1
Control-Alarm C-8042/MRC-114(V)					1	
Pressurizer-Dehydrator ITTFL A2288538G1	1	1	1	1	1	1
Control-Alarm C-6768/GRC						2

Section III. DESCRIPTION

1–9. Van Assembly

The van assembly is a military-type Trailer, Van V–389/MRC–114(V) that has been modified for this application. Modifications to the van (required for mounting equipment, cable entry, waveguide entry, etc) have been made so as not to affect van mobility. The van layout is shown in figure 1–2. Doors in the front, rear, and curbside walls provide access to the van interior. In the van interior, position markings A, B, C, etc, as shown in figure 1–2, designate the areas allocated for the various equipment cabinets. In vans where certain equipments are not used, the designated areas are left vacant. A ground bus enclosed within the van power ducting provides common ground connection for the equipment cabinets. Lighting is provided by incandescent lamps in the ceiling. In addition to the radio equipment, the nodal point radio set van is equipped with three 18,000–BTU air conditioners (providing heating and cooling), a waveguide pressurizer, an antenna deicer control and monitor module, voltage standing wave ratio (vswr) monitoring equipment, three fire extinguishers, a service cart, a desk and two folding chairs, a patch cord and test cable kit, an accessory kit, a tool kit, and instruction books. As shown in figure 1–3, cable connections to external equipment are made through the connector panel located in the roadside wall near the rear of the van; waveguide connections are made through the panels located midway in the roadside wall.

1–10. Transmitting Equipment

The transmitting equipment provides two-channel voice and voice frequency telegraph communication by frequency-modulated microwave radio in the 4.4– to 5.0–gigahertz (gHz) band. Each nodal point radio set uses two transmitter cabinets. Two versions of transmitter pairs are used. One version incorporates a modulator switchover and power divider feature. This transmitter pair is used in the 1–watt nodal point radio set configuration. The other version incorporates an RF switchover feature. This transmitter pair is used in the 1–kilowatt (kw) configurations. External appearances of the two types of transmitters are identical, except for the topmost drawer in the left-hand cabinets of both transmitters. For detailed information on these transmitters, refer to POMM 11–5820–581–15. General information on each type of transmitter is given in *a* and *b* below.

a. Modulator-Switchover Transmitters. In 1–watt configurations, both transmitters provide RF output to their respective antenna feedhorns simultaneously. The baseband signal drives the modulators of both transmitters, and the 70–megahertz (MHz) modulator outputs are fed to a selector switch and power divider. Each arm of the divider drives the modulation circuit in the modulator-exciter drawer of a transmitter. One of the modulators is selected to carry traffic. If it should fail the circuit switches to the alternate modulator, a switchover indicator lights, and an alarm signal is sent to the central equipment cabinet.

b. RF-Switchover Transmitters. In 1–kw configurations, the rf output of each transmitter goes to a selector switch and power divider, each arm of the power divider being coupled to a power amplifier. The power amplifiers feed their respective antenna feedhorns. One of the transmitters is manually selected to drive the power amplifiers; if it fails, the circuit automatically switches to the alternate transmitter and provides indications of switchover and an alarm signal in the central equipment cabinet. For detailed information on both transmitters, refer to POMM 11–5820–581–15.

c. 1–Kw Power Amplifiers. In 1–kw configurations, two power amplifiers are included. Both are driven by the power divider in the transmitter cabinet and each power amplifier feeds a different group of antenna feedhorns. For detailed information on the 1–kw amplifier, refer to POMM 11–5820–603–15.

1–11. Receiving Equipment

The nodal point radio sets use quadruple diversity receivers. The receivers consist of two

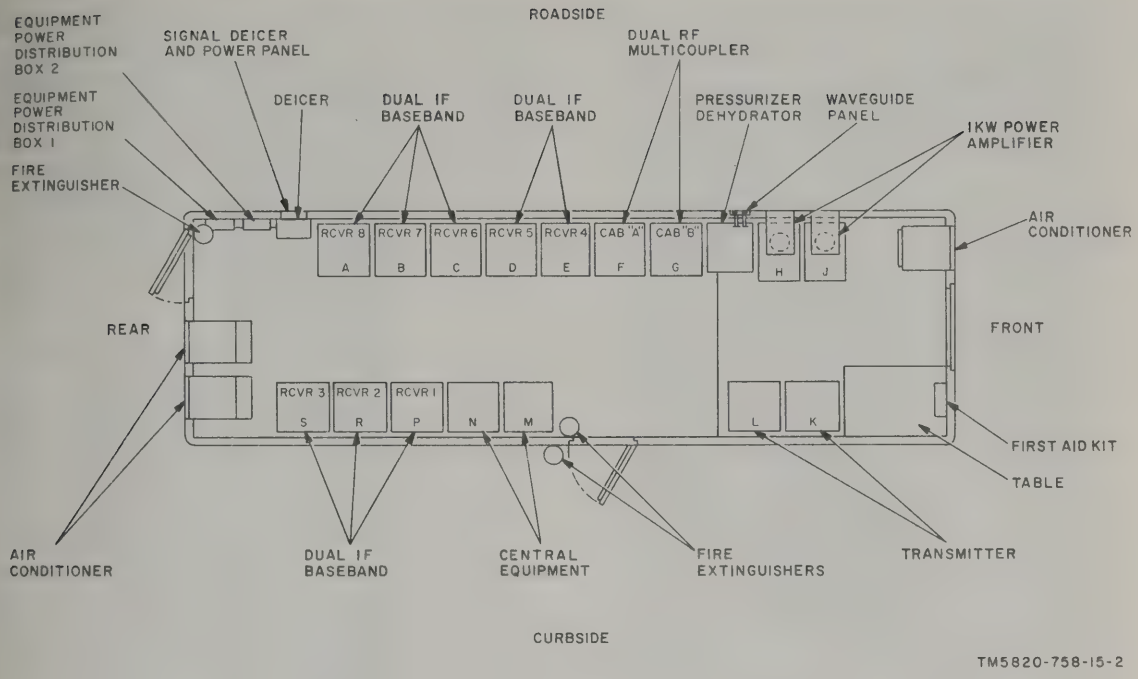


Figure 1–2. Nodal point radio set, equipment location.

dual RF multicoupler cabinets that feed from two to eight dual intermediate frequency (IF) and baseband cabinets. The number of dual IF and baseband cabinets is equal to the number of tributaries being serviced. For detailed information on the receiving equipment, refer to POMM 11–5820–574–15.

1–12. Central Equipment

The central equipment processes all communications between the nodal point site and the tributary sites served by the nodal point radio set. The four major functions performed by the central equipment are: reception of audio signals from the tributary sites and coupling of those signals to the mainline switching equipment and to the local orderwire communications facilities; generation of a composite signal, comprising two voice channels (a carrier channel and an orderwire channel) and digital supervisory signals, for transmission to the tributary sites; provision of orderwire communications between the nodal point radio set and the tributaries it services, other vans and shelters at the nodal site, and mainline sites; and provision of automatic alarms indicative of equipment failures within the nodal point radio set. Two cabinets A and B, are used to house the central equipment. A brief description of the contents of the cabinets is given in *a* and *b* below. For detailed information on the cabinets, refer to POMM 11–5820–575–15.

a. Cabinet A. Cabinet A contains two patch panels and an equipment nest for each tributary being serviced. In vans servicing less than eight tributaries (the maximum number serviceable from a single nodal point radio set), the unequipped positions in the cabinet are covered with blank panels.

b. Cabinet B. Cabinet B contains two central alarm panels, a select panel, a three-nest frame-and-module assembly, a retractable desk, a patch panel, a carrier channel module nest, and drawer space. Cabinet B provides two transmit voice channels, a local orderwire circuit, and equipment failure indicators.

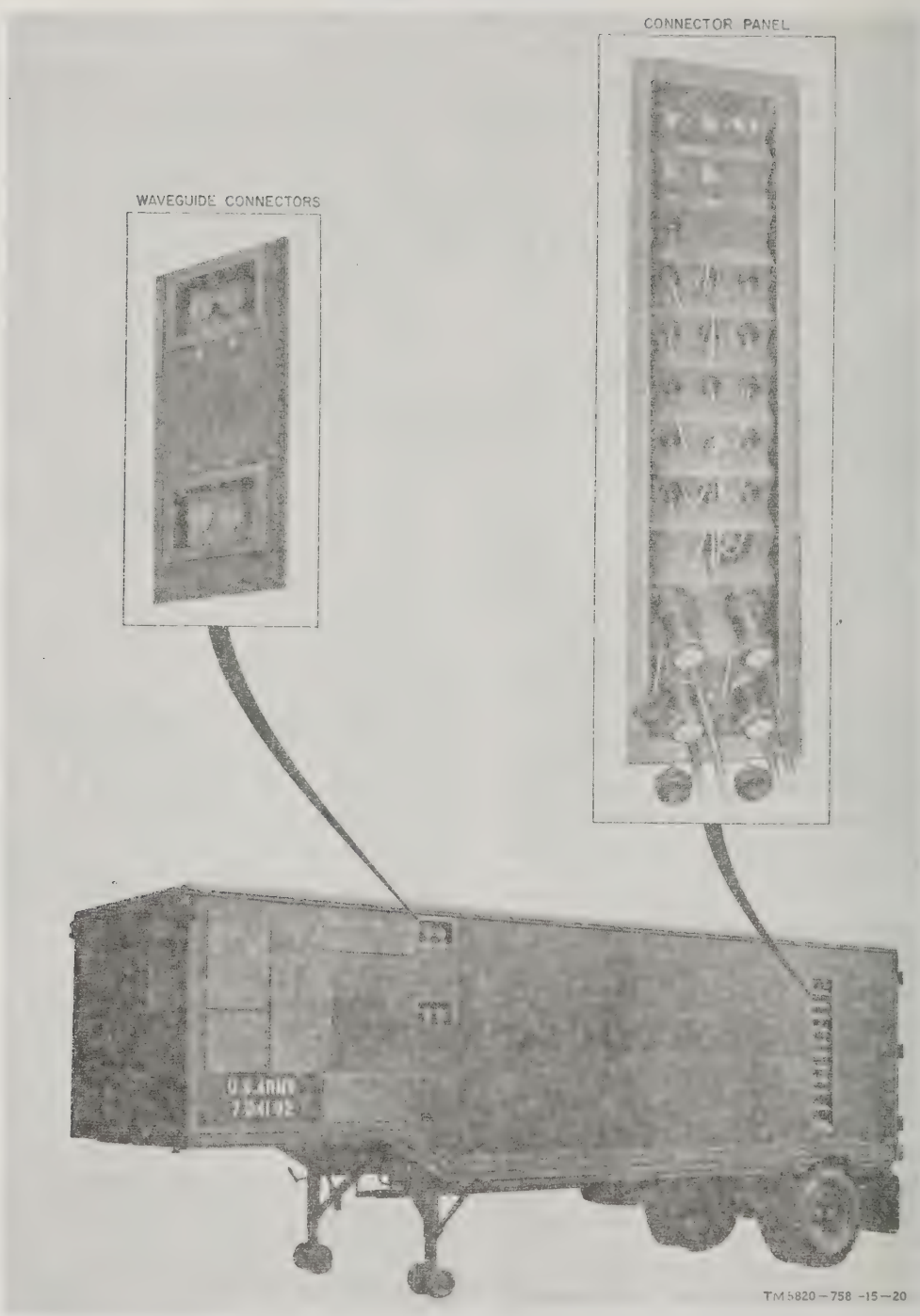


Figure 1-3. Nodal point radio set, external connectors.

1–13. Air Conditioning

Three 18,000–BTU air conditioners (a typical one is shown in figure 1–4) deliver either cooled or heated air to the van interior. Return air is by gravity flow. As shown in figure 1–2, two units are mounted on the rear wall of the van, while a third unit is mounted on the front wall. Intake and exhaust air flow is through vents in either wall of the van. For detailed information, refer to TM 5–4120–222–15.

1–14. Waveguide Pressurizer Dehydrator

The waveguide pressurizer dehydrator maintains a steady flow of pressurized dry air to the external waveguide runs associated with each shelter. The pressure is kept between 0.5 and 1.5 pounds per square inch gage (psig) and the dew point is maintained at –40° F or lower, to avoid condensation in the waveguides. If the pressure drops too low or goes too high, an alarm sounds in the central equipment. No electrical alarm is provided for humidity, which is checked by observing the color of the dessicant.

1–15. Waveguide System

The waveguide system (fig. 1–5) is the RF conducting network that interconnects the transmitting and receiving equipment with the array of power-splitting devices that feed the antenna feedhorns. It consists of two duplexers, four preselectors, and both rigid and flexible waveguide sections.

a. Duplexers. The two duplexers are located immediately behind the four preselectors. Each duplexer enables the transmitting equipment and receiving equipment to use a common waveguide run between antenna and van. It does this by directing transmitted energy to the antenna feedhorn, while preventing this energy from entering the receiver input circuits. Conversely, received energy is directed to the receiver input and prevented from entering the transmitter output. How well the duplexer does the task of directing and isolating received and transmitted energy depends on how closely exit and entry ports on the duplexer are terminated in the correct impedances. A mismatch causes an increase in the voltage standing wave ratio (vswr). One of the ports on the duplexer is terminated in a dummy load. The purpose of the dummy load is to absorb reflected energy, which results from a mismatched termination. A sample of

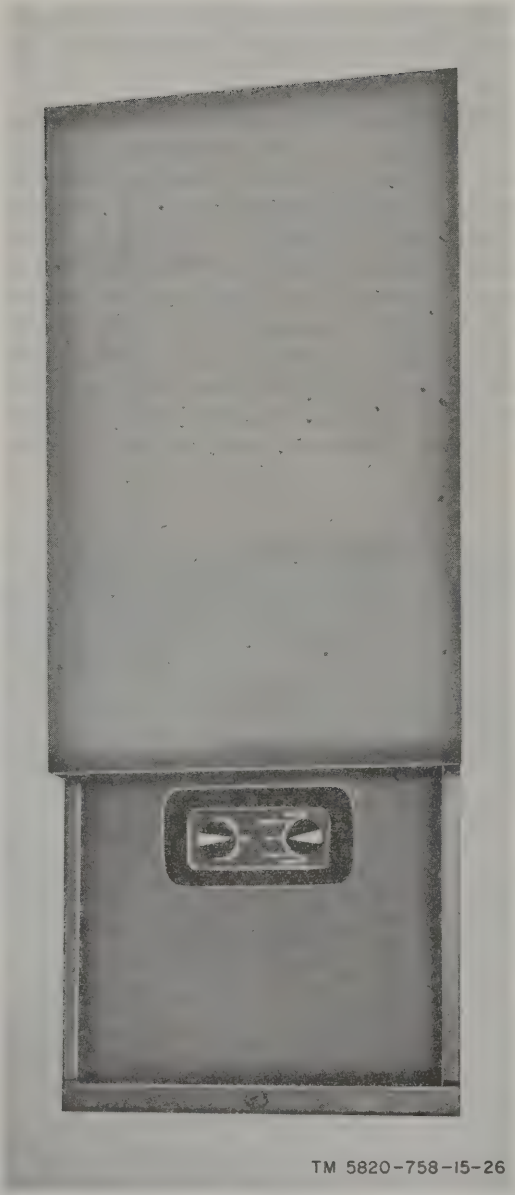


Figure 1–4. Typical air conditioner.

reflected energy is taken from the dummy load and fed to alarm circuits that notify operating personnel when an excessive vswr occurs.

b. Preselectors. Four tuned-cavity preselectors are located in each waveguide run that enters the dual receivers. These are the rectangular assemblies to the right of the receiver cabinets shown in figure 1–5. Each preselector consists of four tunable cavities connected in cascade. Tuning of the four cavities is done simultaneously by a single vernier knob. The bandpass of the preselector is 10 MHz, 5 MHz above and below the rf carrier frequency. The preselectors, because of their restricted bandpass, reject extraneous signals that may inadvertently enter the feedhorns from neighboring microwave equipment.

c. Waveguide Sections. Both rigid and flexible waveguide sections are used in the waveguide runs. Flexible sections are those sections covered with black neoprene. Waveguide interface with the receiver and transmitter cabinets is made by quick-disconnect flanged connectors, four of which are shown directly above the receiver cabinets in figure 1–5.

1–16. Monitoring Equipment

a. Vswr Monitor Alarm Modules. Two vswr monitor alarm modules (fig. 1–6) are provided in 1–watt nodal point radio set configurations. Each module continuously checks

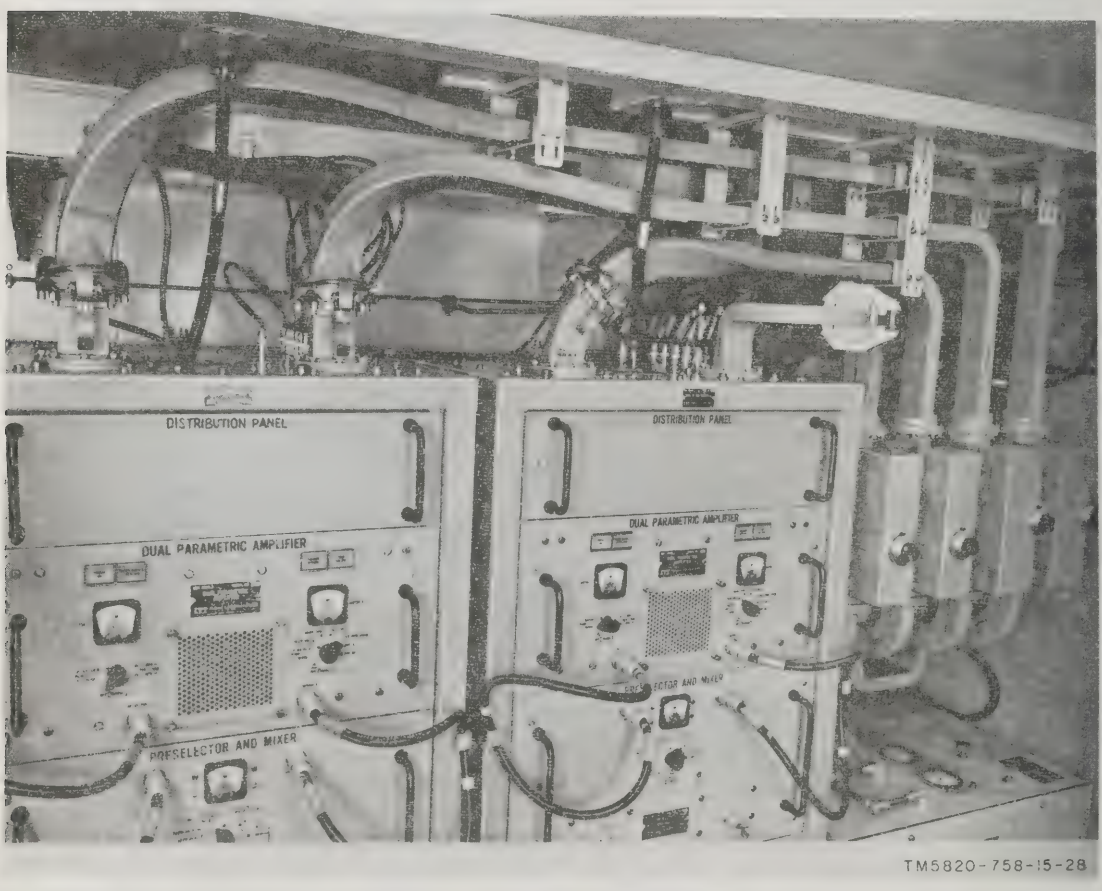


Figure 1–5. Waveguide system receiver waveguide runs.

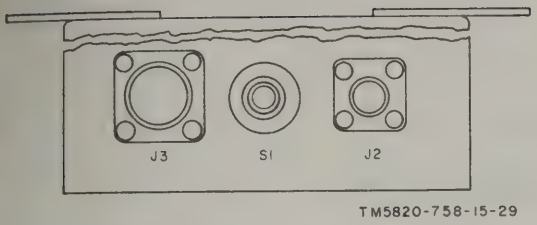


Figure 1-6. Vswr monitor alarm module.

the reflected power of an associated transmitter and actuates alarm circuits in central equipment cabinet (CEC) B in the event of excessive vswr. Vswr monitoring equipment for 1-kw nodal point radio set configurations is contained within the power amplifiers.

b. Deicer Control and Alarm Assembly. The deicer control and alarm assembly (fig. 1-7) controls the application of power to the antenna deicers and actuates alarm circuits in central equipment cabinet B in the event of a heater failure. An indicator on the deicer control and alarm assembly lights red to indicate which heater has failed.

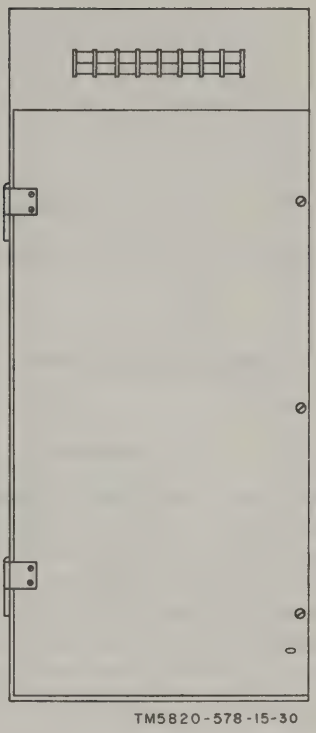


Figure 1-7. Deicer control and alarm assembly.

1-17. Accessories

a. Safety.

(1) *First aid kit.* The first aid kit (fig. 1-2) is mounted in a bracket on the inside front wall above the work bench.

(2) *Fire extinguishers.* Three fire extinguishers (fig. 1-2) are supplied with each van. Two are mounted inside the van in quick-release cradles: one on the roadside wall at the rear of the van near the baseboard, the other just to the left of the curbside door when entering. The third fire extinguisher is mounted on the outside of the van just to the left of the curbside door.

b. Maintenance.

(1) *Instruction books.* Instruction books covering the receiving equipment, transmitting equipment, central equipment, and 1-kw power amplifier are stored in the bottom drawer of cabinet B of the central equipment.

(2) *Patch cord and test cable kit.* The patch cord and test cable kit includes patch cords for use with the central equipment cabinet and test cables for use with the other electronic equipment in the shelter. The kit is stored in the bottom drawer of cabinet B of the central equipment.

(3) *Accessory kit.* The accessory kit includes coaxial adapters and terminations used during maintenance. The kit is stored in a drawer of the service cart.

(4) *Tool kit.* The tool kit contains a wide assortment of general purpose hand tools for maintenance. The tool kit is secured to the bottom of the service cart by mount brackets.

(5) *Service cart.* The service cart provides a convenient, mobile working surface to facilitate equipment maintenance. Two drawers on the cart store the accessory kit and other small maintenance tools.

c. Furniture. A work bench (fig. 1-1) and two folding chairs comprise the van furniture.

CHAPTER 2

INSTALLATION AND CHECKOUT

Section I. INSTALLATION

2-1. Van Emplacement

Careful consideration must be given to emplacement of the nodal point radio set van, since planning has an important bearing on the subsequent performance of the nodal site. General procedures for van emplacement are given in POMM 11-5895-376-15-1. Specific procedures require a rigorous engineering study, which is beyond the scope of this manual. The installation and checkout procedures described in this chapter provide for the situation that may arise if the van is replaced due to damage, a van from spares is added to a site to increase site capability, or a new site is added due to system reconfiguration.

2-2. Service Upon Receipt of Equipment

Check all cabinets and structures for damage incurred in shipment and mechanical security to van walls and floors. Remove drawer-securing hardware from the transmitter, power amplifiers if supplied, receiver, and central equipment cabinets. Check that drawers slide smoothly and are secure in their cabinets. Check module complement of radio equipment by referring to the applicable instruction manuals. Check the front, rear, and curbside doors (fig. 1-2) and all air vents for freedom of movement and mechanical security. Check that connectors and waveguide fittings on the exterior of the van are not damaged or otherwise defective. If the van has been returned from a repair depot, check for any changes made to the equipment. Look for any change information that may accompany the equipment. Insert information concerning changes in technical manuals, schematics, circuit labels, and other pertinent information sources accordingly.

2-3. Power Connection

Before connecting the input power lines to the van insure that these lines are deenergized completely. Check that the ground stud provided on the connector panel on the roadside of the van (fig. 1-3) is securely connected to the grounding system of the mainline site. Follow the procedure given in *a* through *e* below. Refer to figure 6-1 for the schematic diagram.

a. Check that all intercabinet wiring is in accordance with figure 6-2 and is securely fastened.

b. Check that all circuit breakers on the power panels (fig. 1-2) are in the OFF position.

c. Check that all cabinet power controls are in the OFF position. Refer to the applicable technical manual for a description of the controls and indicators on each cabinet.

d. Connect the input power cables to J1 through J21, on the connector panel. Connectors J1 and J2 are equipment power connectors, and J3 and J4 are utility power connectors. Connectors J6 through J21 are deicer power connectors.

e. Energize the input power lines to the van.

2-4. Signal Connections

All signal connections are made to J24 through J31 on the connector panel on the van exterior. Cable identification and purpose are given in POMM 11-5895-376-15-1.

2–5. Waveguide Connections

Four waveguide ports, designated A through D, are located on the roadside bulkhead of the van. The waveguide ports are labeled as shown in figure 1–3. Waveguide runs connect the waveguide ports to the power-splitting arrays. The connections to these arrays differ for each nodal site. Figures 4–5 through 4–10 show the waveguide systems for all nodal sites. These diagrams serve as a guide for learning the constituents of each system.

2–6. Receiver Conversion for Line-of-Sight Links

In line-of-sight tributary to nodal links, dual diversity is used instead of quadruple diversity. This means that only the A1 and B1 receivers are operational. Some of the modules of the A2 and B2 receivers can be removed and used as spares. These modules are: bandpass filter and multicoupler amplifier (both located in the multicoupler drawer). After removing the bandpass filter, terminate the multicoupler with a 75–ohm termination, ITTFL part No. B2130451G1. Other modules located in the IF and baseband cabinets can be removed also; they are: A2 and B2, 2nd mixer and local oscillator; bandpass filter; 9.8–MHz IF amplifier; 9.8 MHz phase combiner and alarm. When the 9.8 MHz IF amplifier and alarm is disconnected from the automatic gain control (agc) amplifier, the open connector on the agc amplifier must be terminated with a 75–ohm termination, ITTFL part No. B2130451-G1. The present nodal configurations have three line-of-sight links: Sector 1 of Site 8.1, Stein, to Sites 39; Site 8.1, Stein, to Site 106; Site 52, Bremerhaven, to Site 93.

Section II. CHECKOUT

2–7. General

a. This section specifies the particular alignment and test procedures required to prepare the nodal point radio set for operation in the system and to verify its performance capabilities. Reference is made to the following equipment manuals for the majority of these test procedures and alignment instructions: Transmitter, ET–A Type NUS 5951, POMM 11–5820–581–15; Nodal Point Receiver, ET-A Types NUS 8021/8024, POMM 11–5820–574–15; and Console, Communications Control OA–8149/MRC–114(V) through OA–8154/MRC–114(V), POMM 11–5820–575–15. The purpose of the procedures given in this section is to test and adjust these equipments in their operational configuration (as a subsystem). These tests and adjustments accomplish the following: they adjust the transmitter deviation for an established input signal level from the CEC; they adjust the transmitter output power level so that it is compatible with the required power amplifier input power (if the power amplifier is used); they verify the receiver sensitivity by performing a receiver threshold test; and they determine if each of the tributary channel bandpass filters, installed in the multicoupler drawers, meet the required center frequency and bandwidth specifications.

b. The requirements to perform these procedures will vary depending upon individual site requirements and on the condition of the particular nodal point radio set. For example, if the site requirement is for a 1–watt transmitter output, the procedure to reduce the transmitter power output to 100 milliwatts, as defined in *a* above, is not required. The procedure described in paragraph 2–11*d* is therefore not required; also, the power amplifier checkout and alignment procedures, described in paragraph 2–12 are not required; however, the procedure given in paragraph 2–11*e* is required. The receiver threshold level measurement is required in all cases. This measurement is made with a translation oscillator which converts the transmitter output signal frequency to the receiver frequency range, thereby providing a receiver test signal. An rf signal generator is used to calibrate the receiver test signal from the translation oscillator.

c. The calibration procedure for the receiver using the rf generator is given in paragraph

2–13*c*. The receiver threshold test procedure using the calibrated translation oscillator is given in paragraph 2–13*e*. Refer to the nodal point receiver equipment manual (POMM 11–5820–574–15) for the turn-on procedures and the alignment procedures. The alignment procedures are required if the receiver threshold level criteria cannot be met but may only require a slight peaking of the rf multicoupler cabinet (as described in POMM 11–5820–574–15) to achieve the specified criteria. In addition, the performance of these alignment procedures will, in many cases, reveal a defective circuit and allow repair and replacement of the malfunctioning component or assembly. An additional test procedure is presented in paragraph 2–13*g* to verify the specified characteristics of the tributary bandpass filters.

d. The alarm test procedures are provided in paragraph 2–14. These tests verify operation of the alarm circuits and indicators on the CEC. The procedure for testing the equipment alarm circuits are given in their respective equipment manuals.

2–8. Test Equipment and Materials Required

a. Test Equipment. Test equipments required for the checkout procedures are listed in the chart below.

Note. One of each of the listed equipments is required, unless otherwise specified.

Description	Manufacturer	Model number	Military equivalent
Signal Generator (HF)	Hewlett-Packard	608–D	Signal Generator SG–309//FRC/47
Vacuum Tube Voltmeter	Hewlett-Packard	400–D	Voltmeter Meter ME–30A/U
Frequency Selective Voltmeter	Sierra	125–B	Electronic Voltmeter ME–275/U
Multimeter	Simpson	260	Multimeter TS–352B/U
Signal Generator (Microwave)	Hewlett-Packard	618–B	Signal Generator AN/URM–52A
Frequency Counter	Hewlett-Packard	5245L	Frequency Meter AN/USM–26
Frequency Converter (20 to 100 MHz)	Hewlett-Packard	5251A	Frequency Meter Subassembly MX–1637/U
Vari-Sweep Generator	Kay	866A	Sweep Generator SG–367/U
Translation Oscillator	ITTFL	NUS 6633 (H1090025G1)	
Power Meter	Hewlett-Packard	430–C	Wattmeter AN/URM–98
Thermistor Mount	Hewlett-Packard	477–B	Radio Frequency Bolometer MX–2144A/U
Waveguide Coax Adapter (6 each required)	Hewlett-Packard	G281–A	
Crystal Detector	Hewlett-Packard	420–A	Semiconductor Device, Diode MX–3671/U
Oscilloscope	Tektronix	561–A	Oscilloscope AN/USM–196
Dual Trace Plug-in	Tektronix	3A72	Preamplifier AM–1839B/USM
Differential Amplifier Plug-In	Tektronix	2A63	Preamplifier AM–1842A/USM
Time Base Plug-in	Tektronix	2B67	Preamplifier AM–3174/USM

Description	Manufacturer	Model number	Military equivalent
Waveguide Termination	Hewlett-Packard	G910–A	Terminator, Waveguide CG–3216/G
Coax Attenuator	Microlab	AB–06N	
Coax Attenuator	Microlab	AB–10N	
Coax Attenuator	Microlab	AB–20N	
Attenuator, Variable	P.R.D. Electronics	G101	Variable Attenuator CN–1095/G
Power Calorimeter complete with Relay and Receptable Box B2331407	Impulse Labs, Inc.	CPW–1500	
2nd Mixer LO Filter Bypass	ITTFL	2386770G1	

b. Materials Required.

Description	Manufacturer	Model number	Quantity	Military equivalent
50–ohm Termination	ITTFL	C2334894 G1 (Bin TG)	3	
75-ohm Termination	ITTFL	C2334876 G1	1	
BNC Straight Adapter (F-F)			1	Adapter (F–F) UG–914/U
BNC Straight Adapter (M-M)			1	Adapter (M–M) UG–491/U
BNC Tee Adapter			4	Adapter, Tee (F–M–F) UG–274B/U
N-Adapter (F-F)			1	Adapter, Straight (F–F) UG–29B/U
Test Cable-1, 4 feet of RG-59B/U with BNC plugs UG–260D/U	ITTFL	B2336243 G1	5	
Test Cable-2 3 feet of RG-214/U with N-Plugs UG-21E/U	ITTFL	B2334494 G1	2	
Test Cable-3 6 feet of RG-214/U with N-plugs UG–21E/U	ITTFL	B2334494 G2	5	

2–9. Utilities Checkout

The nodal point radio set van utilities consist of the dome lights in the van ceiling, convenience outlets situated at strategic locations throughout the van interior, three air conditioners, an antenna deicer monitor, and a waveguide pressurizer dehydrator. Perform the following checkout procedures on these equipments:

a. Nodal Point Radio Set Van Utilities. Check the van utilities as follows:

(1) Apply power to the utility circuits of the van by placing the main circuit breakers in utility power boxes 1 and 2 to the ON position.

(2) In utility power box 1, set circuit breaker CB39 to ON; in utility power box 2, set CB54 to ON. Set the van light switches to ON, and check to see that all dome lights are lighted.

(3) In utility power box 2, set CB53 to ON. Using alternating current (ac) voltmeter, measure 120 ±10 volts at all convenience outlets.

b. Deicer Monitor. Check the deicer monitor as follows:

(1) Set all circuit breakers in utility power box 1 to ON.

(2) Set switch S1 on the deicer monitor panel (fig. 3–5) to ON. With an ac voltmeter, measure 115 volts ac between pins 1 and 2

of connector J6 on the signal and power entry panel on the van exterior (fig. 1–3). Check to see that alarm lamp DS–9 is lighted.

(3) Measure 115 volts ac between pins 1 and 2 of connector J8.

(4) Refer to the chart below, and test the remaining seven deicer circuits in the same manner as described in (2) and (3) above for each switch and its associated connectors as listed.

Deicer Switch	Connector	Indicator
S2	J7 and J9	DS10
S3	J10 and J12	DS11
S4	J11 and J13	DS12
S5	J14 and J16	DS13
S6	J15 and J17	DS14
S7	J18 and J20	DS15
S8	J19 and J21	DS16

c. Air Conditioners. Check the air conditioners as follows:

(1) Set circuit breaker CB34 in utility power box 1 to ON. Open the suction and exhaust vents on air conditioner No. 1, and verify proper direction of airflow at the exhaust vent.

(2) Set the air conditioner function switch to VENTILATE, and verify proper direction of airflow at the exhaust vent.

(3) Test for proper operation of the air conditioner in the COOLING and in the HEATING modes of operation.

Note. A loud knocking noise may be heard when the COOLING mode is first selected. This should disappear after a few seconds of operation. Do not operate the air conditioner if the knocking sound persists.

(4) Set circuit breakers CB47 and CB52 in utility power box 4 to ON. Test for proper operation of air conditioners Nos. 2 and 3.

d. Waveguide Pressurizer Dehydrator. Check the waveguide pressurizer dehydrator as follows:

(1) Energize the waveguide pressurizer dehydrator.

(2) When the waveguide pressure stabilizes, close the valves on the dehydrator. Record the pressure reading, which should be between 0.5 and 1.5 psig.

(3) Check the waveguide pressure at regular intervals until 1 hour has elapsed. If either waveguide run shows a final pressure lower than 80 percent of the original value, locate and repair the leak and repeat the test.

(4) Partially open the purge valve for the A and B ports to obtain a high duty cycle of the dehydrator. Let the dehydrator run for 4 to 6 hours to certify proper operation and to dry out the system. Then, close the purge valves and repeat the procedure for the C and D ports.

2–10. Initial Central Equipment Adjustments

a. Set the main circuit breakers of equipment power boxes 1 and 2 to ON position. Set circuit breakers CB14 and CB15 in equipment power box 1 and CB30 and CB31 in equipment power box 2 to ON.

b. Check to see that the POWER switches on all CEC power supply modules are set ON. All CEC alarm panel indicators should be lighted red or amber, except those for the dehydrator, vswr monitors, deicer, and all indicators marked SPARE. (Refer to POMM 11–5820–575–15.)

c. Press each red, lighted indicator. Each indicator should change color to amber as it is pressed. If the indicator for the dehydrator or deicer is lighted green, pressing the indicator should extinguish the light.

d. If BELL CUTOFF pushbutton on central alarm equipment module is not lighted red, press pushbutton. Pushbutton should turn red, and the bell should be silent.

e. Perform the alignment of the central equipment. Refer to POMM 11–5820–575–15 for the alignment procedure.

2–11. Transmitter Checkout and Alignment

a. Turn on circuit breakers CB5 in equipment power box 1 and CB21 in equipment power box 2.

b. Make sure that the proper crystal, ITT-FL 2335659, of the correct frequency is in the holder of the oscillator multiplier, located in the modulator-exciter drawer of each transmitter. Mark the crystal frequency on the outside of the holder.

c. Refer to POMM 11–5820–581–15 for the turn-on and alignment procedure to be used. Peak tune the transmitters, then broadband the transmitters for increased stability. After the alignment is complete, check to see that both transmitter indicators on the CEC central alarm panel have turned to green. Acknowledge the change of status by depressing the indicators. If power amplifiers are installed, proceed to *d* below. If no power amplifiers are installed, proceed to *e* below.

d. Calibrate the rf drive from the transmitters to the power amplifiers as follows:

(1) On transmitter B, at the modulator-switchover and power divider drawer, press the MANUAL SELECT switch. At the RF-switchover and power divider drawer, press the XMTR A SELECT switch.

(2) Disconnect the coaxial cable on top of transmitter A that feeds power amplifier A. Acknowledge any alarms. Connect test cable –3 (para 2–8) to the output of transmitter A. Terminate the test cable with a 20–decibel (db) coaxial attenuator, Radio Frequency Bolometer MX–2144A/U, and Wattmeter AN/URM–98 (RF power meter).

(3) Adjust RF LEV control J5 within the modulator-exciter drawer of transmitter A for an indication on the RF power meter of 1 milliwatt.

(4) On the front panel of the frequency multiplier drawer in transmitter A, set the meter selector switch to the RF PWR L position.

(5) Adjust FWD potentiometer R30 in the frequency multiplier drawer for a meter indication of 50 (100 milliwatts power output).

(6) In transmitter A, disconnect the coaxial cable from the rear of the frequency multiplier drawer. Terminate the drawer with a 3–db attenuator and a type N coaxial short.

(7) On the front panel of the frequency multiplier drawer in transmitter A, set the meter selector switch to M REFL POWER. Adjust REFL potentiometer R32 in the frequency multiplier drawer for a meter indication of 5; (this corresponds to the 100–milliwatt transmitter output from the switchover unit).

(8) Disconnect the coaxial attenuator and short, and reconnect the cable to the back of the drawer.

(9) Select transmitter B. Repeat the procedure in (2) through (8) above for transmitter B. The transmitters are now adjusted to deliver 100 milliwatts of output power. Proceed to paragraph 2–12 to test the power amplifiers.

e. Set up the vswr alarm levels as follows:

Note. **This procedure applies to 1-watt configuration only.**

(1) With both transmitters set to standby, connect the equipment as shown in figure 2–1.

(2) On the waveguide circulators (Airtron-type only), loosen the locking screw and withdraw each probe to its stop. Finger-tighten the locks.

Note. **Ferotec-type circulators incorporate fixed probes and are not adjustable.**

(3) Locate vswr alarm module B mounted on the roadside wall), and disconnect the rf input cable from the waveguide circulator. Place transmitters A and B in operation. On the waveguide circulator for transmitter A, loosen the probe lock and slowly insert the probe until the VSWR MON A indicator on the CEC alarm panel lights red. Lock the probe in this position. The alarm bell should ring approximately 5 seconds after the

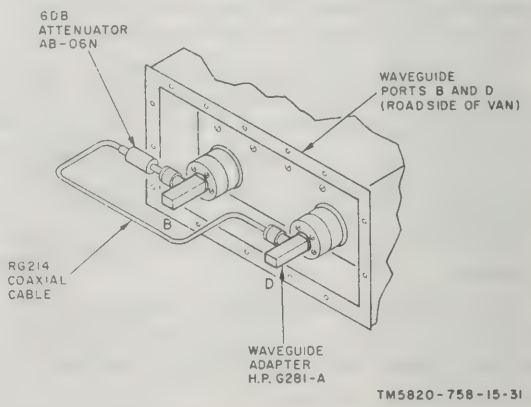


Figure 2–1. Vswr alarm module, alignment setup.

VSWR MON A indicator lights. Depress VSWR MON A switch on the CEC alarm panel to stop the bell and change the indicator from red to amber.

(4) Place transmitter B in standby. Depress the RESET button on vswr module A. The VSWR MON A indicator on the CEC alarm panel should change from amber to green and the bell should ring. Depress VSWR MON A switch to silence the bell. Reconnect the vswr module RF cable that was removed in (3) above.

(5) Locate vswr alarm module A (mounted on the roadside wall), and repeat the procedures in (3) and (4) above to adjust waveguide circulator B. The vswr alarm indication will be provided by VSWR MON B indicator on the CEC alarm panel. Following this, disconnect all test equipment and return all connections to normal.

2–12. Power Amplifier Checkout and Alignment

a. Turn on circuit breakers CB2 in equipment power box 1 and CB18 in equipment power box 2.

b. Refer to POMM 11–5820–603–15 and perform the starting procedure and the initial alignment and adjustment procedures. When these procedures are completed, place the power amplifiers in standby by depressing the BEAM SWITCH.

c. Connect the test equipment as shown in figure 2–2. Turn the RF load power on, and perform the following to set up the vswr alarm protection circuits for the power amplifiers.

(1) On each power amplifier, turn the BEAM VOLTAGE adjust control fully counterclockwise.

(2) On each circulator (Airtron-type), loosen the vswr probe and decouple it as far as it will go by pulling gently until the stop is reached. Finger-tighten the lock. (Ferrotec circulators have fixed probes).

(3) Make sure that each BEAM SWITCH is red. If not, depress it to make it red.

(4) Turn on both power amplifiers. Verify that all indicators turn green except LOW RF, BEAM SWITCH, and BEAM. Depress the RESET button if necessary. Make sure that the test RF cable from port B is connected to the waveguide adapter of the RF load.

(5) Depress BEAM SWITCH on power amplifier B. Turn the BEAM VOLTAGE adjust control clockwise in small steps, checking the calorimetric power meter for an indication of 100 watts.

(6) If the RF power meter drifts from 100 watts, vary the attenuation of AT1 (in the klystron compartment) until the RF power meter reads 100 watts when stabilized. Calibrate the RF MONITOR meter on the front panel of the power amplifier, with the ANTENNA FORWARD WATTS X10 button depressed.

(7) Depress the BEAM SWITCH to reduce the power amplifier power output to 0. Remove the end of the test cable from the Power Calorimeter CPW–1500, and transfer it to the waveguide adapter on part D.

(8) On the antenna mismatch control card in the power amplifier A drawer, turn the mismatch control fully counterclockwise.

(9) Depress the BEAM SWITCH on power amplifier B. Observe the RF MONITOR meter. It should stabilize at the RF MONITOR meter reading obtained in (6) above.

(10) Depress the BEAM SWITCH on power amplifier A to activate the alarm circuit. The BEAM SWITCH and BEAM indicators should be green. On the antenna mismatch card, turn the mismatch control slowly clockwise until the BEAM and ANT MISMATCH indicators turn red. If it is not possible to make them turn red by turning the control fully clockwise, set the control to three-fourths of its travel clockwise and lock it. Then loosen the probe on waveguide circulator A, and insert it very slowly until the BEAM and ANT MISMATCH indicators turn red. Lock the circulator probe. On power amplifier B, depress the BEAM SWITCH to turn off the beam voltage. On power amplifier A, depress the RESET button to reset the alarm circuit.

(11) Repeat the procedure in (5) through (10) above for power amplifier A. Connect the RF power meter to port D, and calibrate

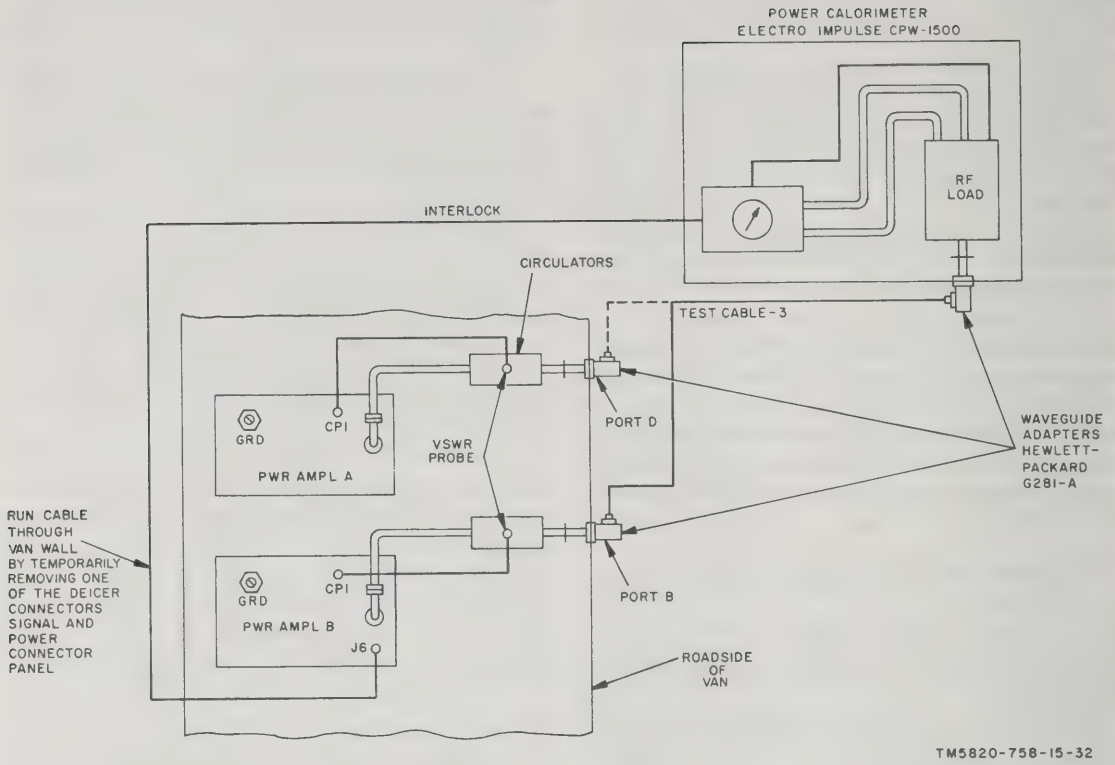


Figure 2-2. Power amplifier vswr alignment, test setup.

the power amplifier A RF output to 100 watts. Adjust circulator B if necessary.

2-13. Receiver Threshold Test

a. General. The receiver threshold test is performed in a sequence of four basic operations as described below:

(1) After performing preliminary procedures prior to operating the equipment, the receiver calibration curve is plotted (with Signal Generator AN/URM-52A (RF generator) to determine an attenuation reference. This operation requires the test setup to be accomplished and the multicoupler bandpass filters bypassed to provide broadband operation of the complete receiver (that is the multicoupler cabinet and the IF and baseband cabinet under test).

(2) Next, the translation oscillator is adjusted for the particular tributary IF and baseband frequency under test. This operation requires installation of the assigned multicoupler filter and insertion of the specified crystal into the translation oscillator for the tributary channel being tested.

(3) The translation oscillator calibration curve is plotted next (for various attenuator settings) using the receiver calibrative curve reference derived in (1) above. The translation oscillator calibration curve indicates the level of the receiver test signal output of the translation oscillator.

(4) Finally, the receiver threshold level is determined for the receiver comprised of the IF and baseband drawer under test and its associated circuits in the rf multicoupler drawer. The entire procedure (1) through (4) above must be performed for each dial RF multicoupler cabinet and tributary IF and baseband cabinet installed in the nodal point radio set.

Note. There are two multicoupler cabinets incorporated in the nodal point radio set van: the cabinet in position F of the van is referred to as the A-cabinet; the cabinet in position G is referred to as the B-cabinet. Each of these cabinets incorporates two multicoupler drawers; the upper drawers in each cabinet are referred to as A1 and B1, respectively; the lower drawers are referred to as A2 and B2, respectively.

Note. Every tributary requires an IF and baseband cabinet; each cabinet incorporates two IF and baseband drawers. The upper drawer is referred to as the A-channel; the lower drawer is referred to as the B-channel.

b. Preliminary Procedures. The following procedures will be performed prior to operating the equipment:

(1) Determine the assigned transmitter and receiver frequencies, and record them on the test data sheets. The ET–A system requires a frequency separation of either 100 MHz or 120 MHz for operation.

(2) Obtain the crystals for the translation oscillator required to test each tributary channel that is supplied in the nodal point radio set van. These crystals are specified in the chart below. The translator crystal oscillator frequency is tripled and mixed with the input transmitter signal to produce the receiver test signal.

Channel	Frequency separation (transmitter-receiver)	
	100 MHz Crystal No.	120 MHz Crystal No.
1	33.26667 MHz	39.93333 MHz
2	33.66667 MHz	40.33333 MHz
3	33.00000 MHz	39.53333 MHz
4	33.80000 MHz	40.46667 MHz
5	33.40000 MHz	40.06667 MHz
6	32.86667 MHz	39.53333 MHz
7	33.13333 MHz	39.80000 MHz
8	33.53333 MHz	40.20000 MHz

(3) Check to see that the internal module switches in the dual RF multicoupler cabinet and in the IF and baseband cabinets are in the following positions:

Drawer	Module	Switch	Position
Preselector and mixer	Mixer Preamplifier	METER SELECT	OSCILLATOR 1
IF and baseband	IF amplifier	AGC	EXT
	Agc amplifier:	AUTO-MANUAL	AUTO
		QUAD/DUAL	QUAD
	Phase combiner:		
	#1	ALM TEST	Ø
	#2	ALM TEST	Ø
	#1 and 2	OFF/DELAY	OFF

(4) Connect the U-links for the active tributary channels in the nodal point radio set van. These are connected at the patch panels on central equipment cabinet B between the EQUIP and OUT jacks for each receiver channel (1A and 1B, 2A and 2B, etc).

(5) Energize the nodal point radio set van equipment and all test equipment, and operate for a period of 2 hours prior to conducting the test procedures.

c. Plotting the Receiver Calibration Chart. This chart provides an attenuation reference for calibration purposes. The chart is plotted by connecting a calibrated RF generator to the input of one receiver channel and monitoring the variations of receiver noise level with an Electronic Voltmeter ME–275/U (frequency selective voltmeter) connected to the baseband output. The RF generator carrier level is varied by means of the rf generator attenuator dial from –45 decibels (referred to 1 milliwatt into 600 ohms) (dbm) to –85 dbm and the frequency selective voltmeter readings are tabulated for each incremental dbm attenuator setting. This test is performed with the receiver operating in a broadband configuration. Perform this test as follows:

(1) At the top of dual RF multicoupler cabinet A, disconnect the RF (input 1 waveguide) quick-disconnect fitting (top left waveguide input) and connect a waveguide-to-coaxial adapter (fig. 2–3).

(2) Locate the bandpass filter for the tributary channel being tested in the upper RF multicoupler drawer (A1) of dual RF

multicoupler cabinet A, and bypass this filter with a BNC ADAPTER, type UG-914/U.

(3) Locate the 9.8-MHz filter (1) in the upper IF and baseband drawer of the tributary channel cabinet being tested, and bypass this filter with the special purpose 2nd mixer LO filter bypass unit, ITTFL part No. B2386770G1 (fig. 2-4).

(4) Locate cable W10 in the upper IF and baseband drawer of the tributary channel cabinet being tested, and disconnect this cable from OUT jack J16 of the IF amplifier 2 module.

(5) Connect AN/USM-196 vertical input to the BASEBAND A OUTPUT jack on the IF and baseband cabinet distribution panel (fig. 2-5).

(6) Calibrate the RF generator, and set its variable attenuator to -75 dbm. Slowly tune the RF generator output frequency to the operating receiver frequency to obtain the best noise quieting (this is denoted by minimum noise amplitude on the oscilloscope display). Be certain that the RF generator indicates approximately the receiver operating frequency.

(7) Determine the loss in the test cable. This is accomplished by disconnecting the test cable from the receiver input and connecting the RF generator output through the test cable to the input of a AN/URM-98 with Thermistor Mount HP 477-B (fig. 2-6). When the RF generator variable attenuator is set to 0 dbm, the cable loss can be read directly on the RF power meter as the minus difference from 0 dbm.

Note. Check to see that the RF generator POWER SET meter is adjusted to the zero CAL point for the above reading. If the indicated cable loss is 3 dbm or less, the POWER SET can be adjusted in the plus direction the required amount in dbm to compensate the indicated loss. If the loss is in excess of 3 dbm, it should be noted and entered in all subsequent calculations that involve the RF generator attenuation readings.

(8) Reconnect the RF generator test cable to the RF Waveguide Coax Adapter HP G281-A (fig. 2-3). Set the attenuation dial to -40-dbm output.

(9) Connect the Frequency Meter AN/USM-26 (frequency counter) to the IF OUTPUT 1 jack on the preselector and mixer drawer of dual RF multicoupler cabinet A (fig. 2-7). Slowly tune the RF generator signal frequency to obtain the correct tributary channel IF center frequency (with 10-kHz tolerance) for the tributary channel being tested. When this is accomplished, remove the frequency counter test cable from the IF OUTPUT 1 jack and reconnect the signal cable that was disconnected for this adjustment.

(10) Disconnect the AN/USM-196 test leads from the BASEBAND A OUTPUT jack, and connect a test lead from the BASEBAND A OUTPUT jack to the input of Electronic Voltmeter ME-275/U (fig. 2-8).

(11) Calibrate the frequency selective voltmeter as described in its instruction manual, and place the front panel switches to the following positions:

(*a*) Set the FUNCTION SELECTOR switch to SEL. VM 250 Hz.

(*b*) Set the LINE IMPEDANCE switch to 600 ohms.

(*c*) Set the ATTENUATOR DBM switch to -60 dbm.

(12) Adjust the frequency selective voltmeter FREQUENCY dial to the 70-kHz slot. Adjust the RF generator output attenuator to -85 dbm. Set the frequency selective voltmeter attenuator to obtain an approximate midscale reading on the meter. Add this reading to the ATTENUATOR DBM switch setting, and record the total attenuation opposite the -85-dbm receiver input carrier level.

(13) Adjust the RF signal attenuator of the RF generator to -80 dbm, and readjust the frequency selective voltmeter ATTENUATION DBM switch to obtain approximately the mid-scale reading on the meter that was obtained in (12) above. Add the meter dbm reading to the ATTENUATION DBM switch setting (algebraically), and record the total attenuation opposite the -80-dbm receiver input carrier level. Repeat this procedure for settings of -75-dbm, -65, -55, and -45 dbm of the rf generator attenuation dial, recording the total required attenuation of the frequency selective voltmeter opposite the receiver input carrier level. These recorded values will be used to plot the translation oscillator calibration chart (*d* below).

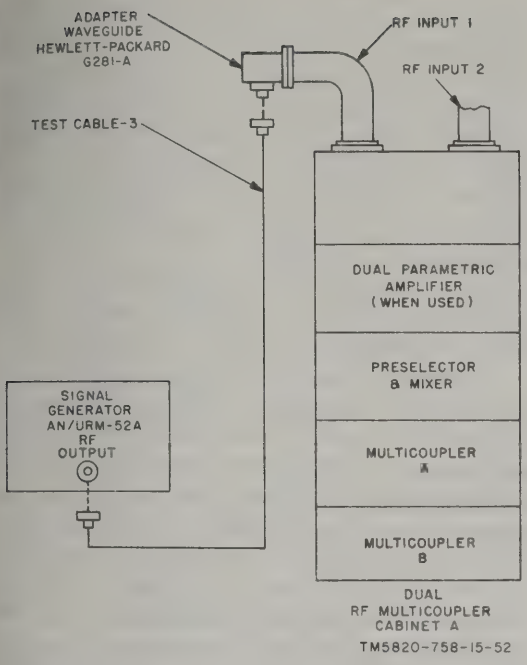


Figure 2–3. RF generator hookup to RF multicoupler cabinet A.

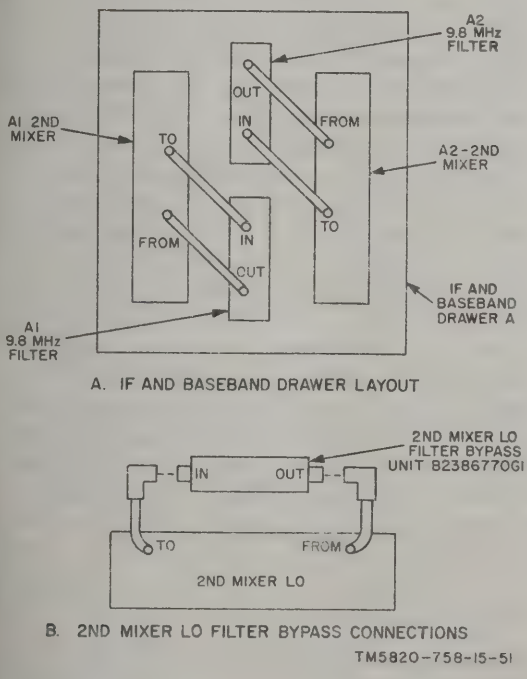


Figure 2–4. 9.8–MHz filter bypass installation.

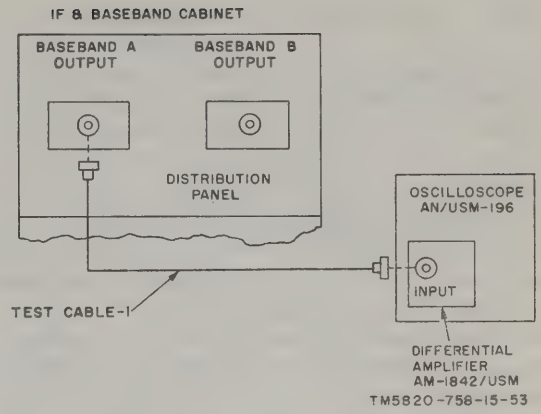


Figure 2–5. AN/USM–196 hookup to IF. and baseband cabinet.

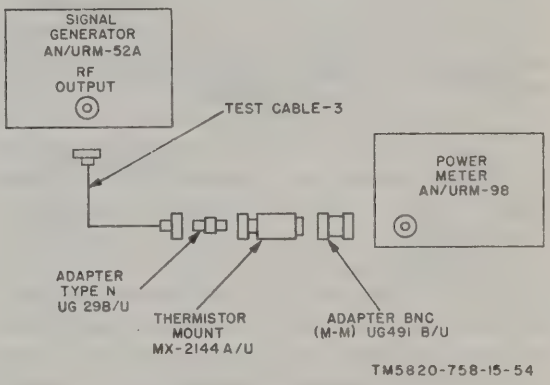


Figure 2–6. RF generator hookup to RF power meter.

d. Plotting Translation Oscillator Calibration Chart. This chart provides a means of accurately determining the actual test signal input level to the receiver, for discrete settings of the test setup Variable Attenuator CN–1095/G (variable attenuator) (fig. 2–9). This attenuator is variable from 0 to 60 dbm. Using the values of attenuation-versus-receiver carrier level obtained in *c*(12) and (13) above, a chart is prepared which will relate the test setup variable attenuator settings to the actual receiver rf input signal level. Proceed as follows:

(1) Disconnect RF generator from the test cable, and connect the test cable to the RF output jack of the translation oscillator. Connect the equipment as shown in figure 2–9.

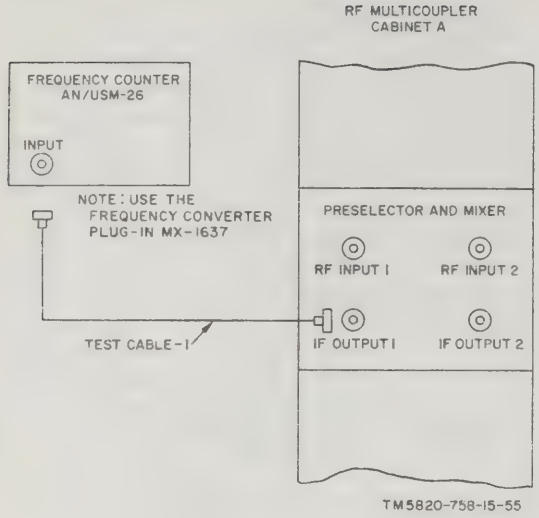


Figure 2-7. Frequency counter hookup to RF multicoupler cabinet A.

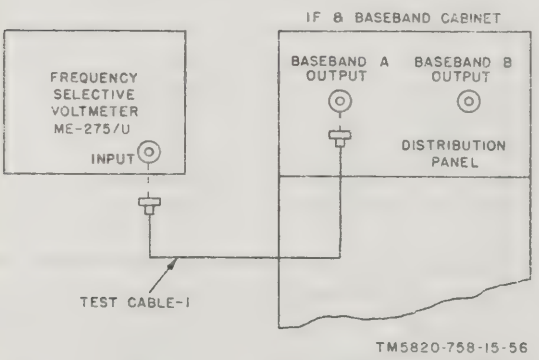


Figure 2-8. Frequency selective voltmeter hookup to IF and baseband cabinet.

(2) Adjust the variable attenuator in the test setup to approximately 30 dbm, and set the ATTENUATION DBM switch on the frequency selective voltmeter to the –60 dbm setting.

(3) Connect the AN/USM–26 to the IF OUTPUT 1 jack on the preselector and mixer drawer of dual RF multicoupler cabinet A (fig. 2–7). Observe the AN/USM–26 reading. If necessary, reduce the variable attenuator setting to obtain an AN/USM–26 reading. The AN/USM–26 should indicate the assigned tributary channel IF frequency under test (re fer to the chart in paragraph 2–13*b* for th correct crystal to install in the translation oscil lator for the tributary channel under test). I the correct tributary channel IF frequency i indicated, within a 10–kHz tolerance, procee with (4) below. If not correct, determine wha is wrong in the test setup, the equipmen under test, or the test equipment before pro ceeding with (4) below.

(4) Disconnect the AN/USM–26 fron the IF OUTPUT 1 jack, and reconnect th signal cable that was removed in step (3).

(5) Set the ATTENUATION DBM switch on the frequency selective voltmeter t the recorded position obtained in *c*(12) above and adjust the variable attenuator in the tes setup to obtain the same reading on the fre quency selective voltmeter as was recorded i *c*(12) above. Refer to the translation oscillato calibration chart shown in figure 2–10, an plot a point at the intersection of the –85–dbn horizontal and the variable attenuator setting Draw a straight line through the plotte points. The translator calibration chart thereb obtained allows determination of the rf inpu level to the receiver to measure the receive breakpoint. Be certain to enter into the break point calculation the conversion loss of th translation oscillator. This increases the tota attenuation by approximately 30 dbm; for ex ample, the recorded –85 dbm on the chart wil be equivalent to a –115–dbm input to the re ceiver, with the addition of the conversio loss; the recorded –75 dbm on the chart wil be equivalent to a –105–dbm input to the re ceiver; the recorded –65 dbm on the chart wil be equivalent to a –95–dbm input to the re ceiver, etc. The range of values pertinent t the receiver threshold measurement is –10 dbm to 111.5 dbm. The translation oscillato conversion loss must be accurately determine for the threshold test procedure. This loss i determined in (6) through (8) below.

(6) Place transmitter cabinet A to the STANDBY mode of operation.

(7) Disconnect the rf input to the trans lation oscillator from the transmitter cabinet A frequency multiplier drawer, and connect the test cable to the input of an AN/URM–98

with the MX–2144A/U. Calibrate the power meter as described in TM 11–6625–433–15.

(8) Turn on transmitter cabinet as described in POMM 11–5820–581–15 for Transmitter, ET–A Type NUS 5951. Measure the power output at the test cable. (This should be –30 dbm below the nominal 1–watt output or 1 milliwatt.) Add the difference in the AN/URM–98 reading from 1 milliwatt to the 30–dbm fixed attenuation value in the signal path (fig. 2–9); record the total value obtained. This will be used in the receiver threshold test procedure *e* below as the conversion loss of the translation oscillator to obtain the actual test signal RF input level to the receiver.

(9) Turn off transmitter cabinet A and disconnect the AN/URM–98 from the test cable. Reconnect the test cable to the RF input of the translation oscillator as shown in figure 2–9.

(10) Disconnect the adapter in upper RF multicoupler drawer A1 of dual RF multicoupler cabinet A, and reconnect the tributary channel band pass filter removed in (2) above.

(11) Disconnect the 2nd mixer LO filter bypass unit installed in the upper IF and baseband drawer of the tributary channel cabinet being tested, and reconnect the 9.8–MHz filter unit that was disconnected in (3) above.

e. Performing Receiver Threshold Level Test (With Calibrated Translation Oscillator). To perform this test, proceed as follows:

(1) Connect the equipment as shown in figure 2–9.

Note. The procedures in *c* and *d* above must be accomplished before proceeding with (2) through (13) below.

(2) Connect the frequency selective voltmeter to the BASEBAND A OUTPUT jack on the IF and baseband cabinet distribution panel of the tributary channel being tested. Calibrate the frequency selective voltmeter as described in the instruction book, and set the front panel controls to the following positions:

(*a*) Set the FUNCTION SELECTOR switch to SEL. VM 250 Hz.

(*b*) Set the LINE IMPEDANCE switch to 600 ohms.

(*c*) Set the ATTENUATOR DBM switch to –60 dbm.

(3) Adjust the frequency selective voltmeter FREQUENCY dial to between 13 and 19 kHz, but do not select 16 kHz. (This is a harmonic of the pilot tone.)

(4) Determine the receiver threshold level by incrementally increasing the attenuation of the receiver test signal with the test setup variable attenuator, in 1–dbm steps and plotting the frequency selective voltmeter attenuation readings on a graph as shown in figure 2–11. Observe the typical example shown in figure 2–2; the rate of change of the slope is linear until the receiver breakpoint is reached; then, the readings abruptly drop to a vertical rate of change. This occured in the example shown, at a variable attenuator setting of 18 dbm. If you refer to the typical translation oscillator calibration curve shown on the graph of figure 2–12, this particular variable attenuator setting corresponds to a calibrated receiver input carrier level of –73 dbm. The translation oscillator conversion loss, determined in *d*(8) above must be added to this value to determine the actual receiver input carrier level. Assume for this example that the translation oscillator loss is –33 dbm (–30 dbm fixed plus –3 dbm indicated on the AN/URM–98). This value of –33 dbm is added to the indicated receiver input carrier level of –73 dbm to calculate the actual receiver carrier input level at the threshold point of –106 dbm. The minimum performance criteria for receiver threshold level is –111.5 dbm with a parametric amplifier installed and –104.5 without a parametric amplifier.

(5) Reconnect cable W10 in the upper IF and baseband drawer of the tributary channel cabinet being tested to the OUT jack J16 of IF amplifier 2 module. This was originally disconnected in *c*(4) above to disable the A2 channel of the tributary if. and baseband cabinet being tested.

(6) Disconnect cable W7 in the upper IF and baseband drawer of the tributary channel cabinet being tested from the OUT jack J16 of the IF amplifier 1 module.

(7) Disconnect the RF test cable and adapter from the RF input 1 waveguide at the

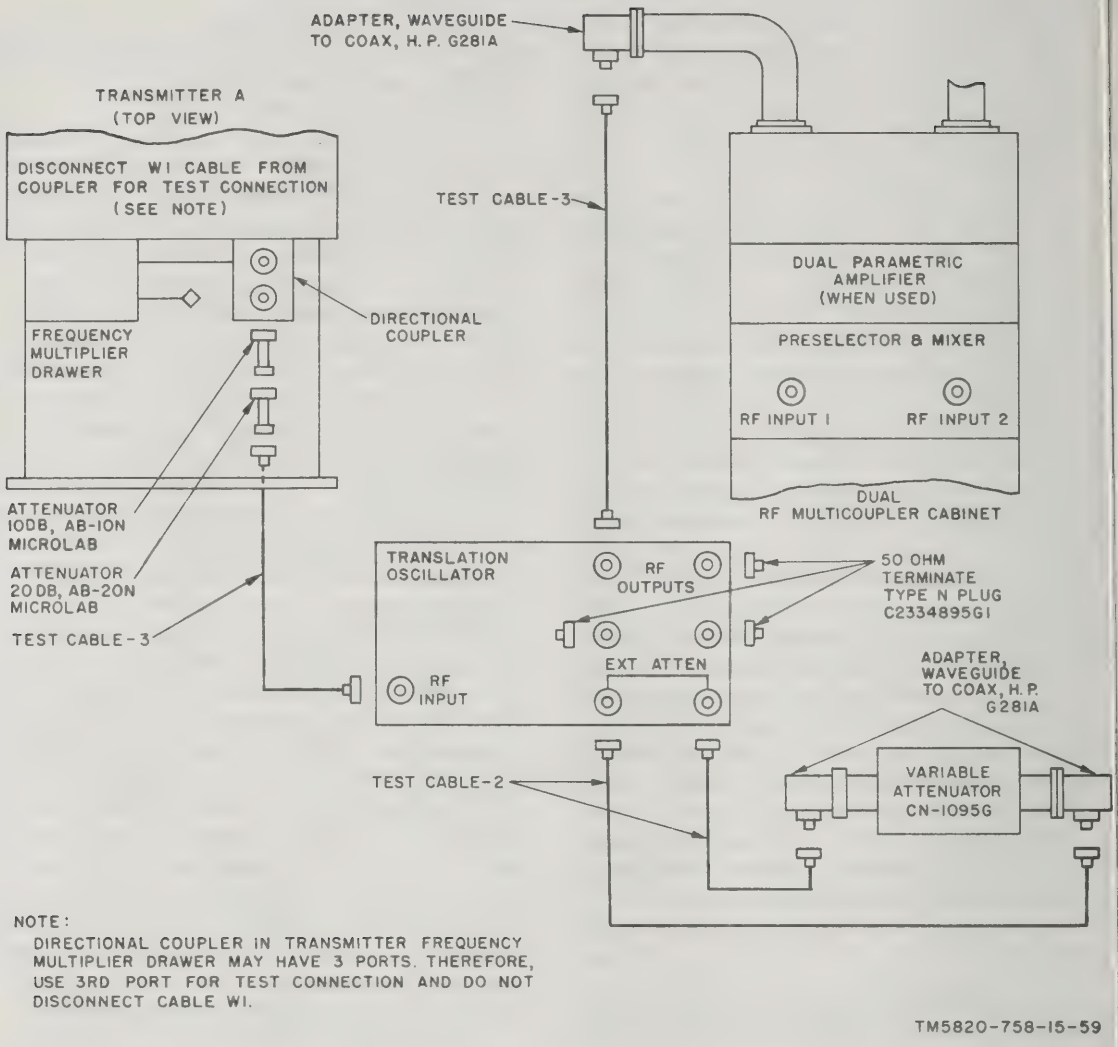


Figure 2-9. Translation oscillator hookup to rf multicoupler cabinet.

top of dual RF multicoupler cabinet A, and connect it to the RF input 2 waveguide quick-disconnect fitting at the top right of the same cabinet.

(8) Connect the frequency selective voltmeter to the BASEBAND A OUTPUT connection on the IF and baseband distribution panel.

(9) Repeat the test procedure detailed in (3) and (4) above for the A2 multicoupler channel and the A channel of the IF and and baseband cabinet.

(10) At the end of the test specified in (9) above, reconnect cable W7 that was removed in (6) above.

(11) Connect the translation oscillator RF output to both RF input 1 and 2 on the top of dual RF multicoupler cabinet A, and make a combined receiver threshold level test for multicoupler channels A1 and A2.

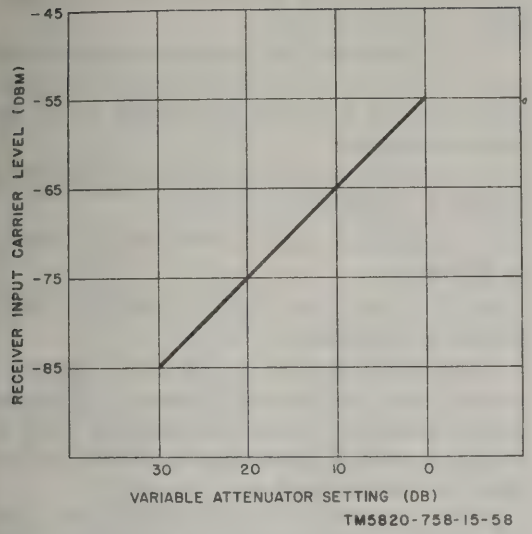


Figure 2–10. Translation Oscillator calibration curve.

(12) Disconnect all test equipment from dual RF multicoupler cabinet A, and reconnect all waveguide fittings. Disconnect the frequency selective voltmeter from the BASEBAND A OUTPUT jack on the IF and baseband distribution panel, and connect the frequency selective voltmeter input to the BASEBAND B OUTPUT jack on the same panel.

(13) Repeat the entire test procedures detailed in *c*, *d*, and *e* above for the dual rf multicoupler cabinet B channels and the baseband cabinet B1 and B2 channels.

f. Performing Receiver Threshold Level Test (With Stable Rf Generator). An RF generator can be used in place of the translation oscillator as described in *e* above. Using this method of testing eliminates the need for plotting of the calibration charts as described in *c* and *d* above. The stability requirements for the RF generator are stringent to maintain the RF input signal within the passband of the tributary channel filters in the multicoupler drawer. To determine if the RF generator stability is acceptable, connect the rf generator into the test setup shown on figure 2–13. Connect the AN/USM–26 to connector jack J7 on the top of dual RF multicoupler cabinet A (this is the tributary one IF output for channel A1–B1). Calibrate the signal generator, and allow it to operate for at least 1 hour. Set the RF generator for a –60–dbm output, and slowly tune the Frequency dial to obtain a reading of 69.8 MHz; this is the tributary channel one IF. If necessary, reduce the RF generator RF attenuator setting to achieve the frequency counter indication. Monitor the frequency reading; if the indication remains within 2 kHz of the IF setting for a 90–second interval, the RF generator is acceptable as a source of the RF test signal in place of the transmitter. The advantages of using the RF generator in place of the transmitter are: the attenuation readings for the receiver

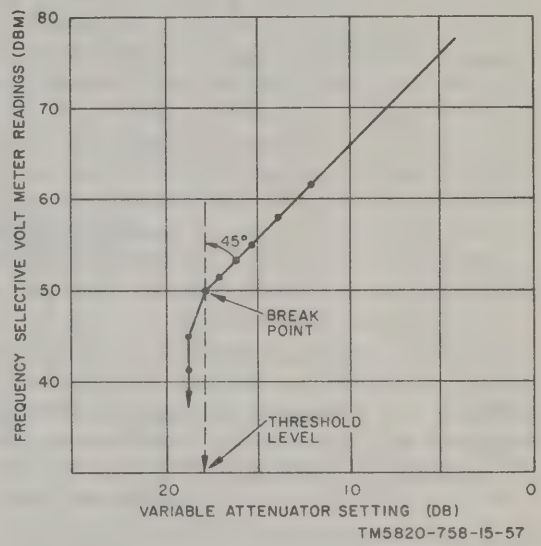


Figure 2–11. Receiver threshold level graph.

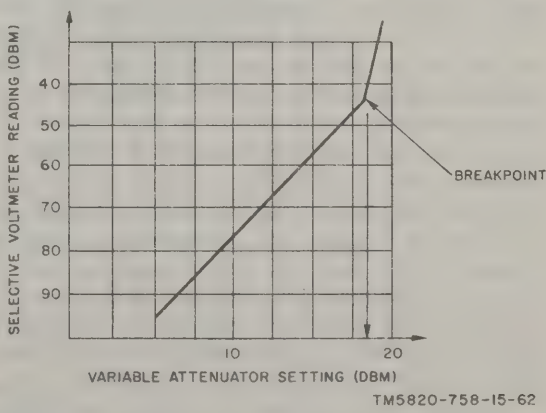


Figure 2–12. Typical receiver threshold graph.

threshold test determination are directly read from the RF generator attenuation dial without the need for reference graphs, the test procedure is greatly simplified since only the procedure in *e* above is necessary; there is no need to recalibrate the test equipment when it is desired to test out another tributary channel with its associated dual RF multicoupler filters and assigned IF and baseband cabinet. To perform the receiver threshold level test using the RF generator, proceed as follows:

(1) Connect the equipment as shown in figure 2–14. In this configuration, only the four-way coaxial power divider is used in the translation oscillator and the mixer section is bypassed. The RF test signal is attenuated approximately 6 dbm through this network; the exact attenuation factor is determined and compensated as follows: connect the AN/URM–98 to RF output lead 1 of the translator oscillator as shown in figure 2–14; calibrate the AN/URM–52A as described in TM 11–6625–214–50; set the MOD SELECTOR switch of the AN/URM–52A to CW; adjust the ATTENAUTOR control on the AN/URM–52A to obtain a reading of –6 dbm on the AN/URM–98; adjust the AN/URM–52A POWER SET control to position the attenuator bezel to the –6 dbm marking on the ATTENUATOR control. The test setup has now been calibrated to read the RF test signal input level to the multicoupler cabinet directly from the AN/URM–52A ATTENUATOR control dial. Correct the AN/URM–98 to each of the other translation oscillator output leads, and check to see that the output level from each is within 0.5 dbm of the –6 dbm setting; be certain to terminate each of the other leads with 50 ohms when making these measurements.

(2) Connect the equipment as shown in figure 2–15.

(3) Connect the AN/USM–26 to the IF OUTPUT 1 jack on the preselector and mixer drawer of the dual RF multicoupler cabinet A (fig. 2–7). Slowly tune the RF generator signal frequency to obtain the correct tributary IF channel frequency (within 10 kHz) for the tributary channel being tested. When this is accomplished, remove the frequency counter test cable from the IF OUTPUT 1 jack and reconnect the signal cable that was disconnected for this adjustment.

(4) Calibrate the frequency selective vo meter as described in its instruction manu and place the front panel switches to the f lowing positions:

(*a*) Set the FUNCTION SELECTC switch to SEL. VM 250 Hz.

(*b*) Set the LINE IMPEDANCE swit to 600 ohms.

(*c*) Set the ATTENUATOR DB switch to –60 dbm.

(5) Determine the receiver thresho level as described in *e*(4) through (13) abov except read the receiver breakpoint level d rectly from the RF generator ATTENUATIO dial; no translations are required.

g. Testing 200–kHz Bandpass Filters. The filters are installed for each individual trib tary channel. Connect the tributary chann filter and its associated multicoupler amplifi into the test setup shown in figure 2–16. D not remove these units from the multi-couple

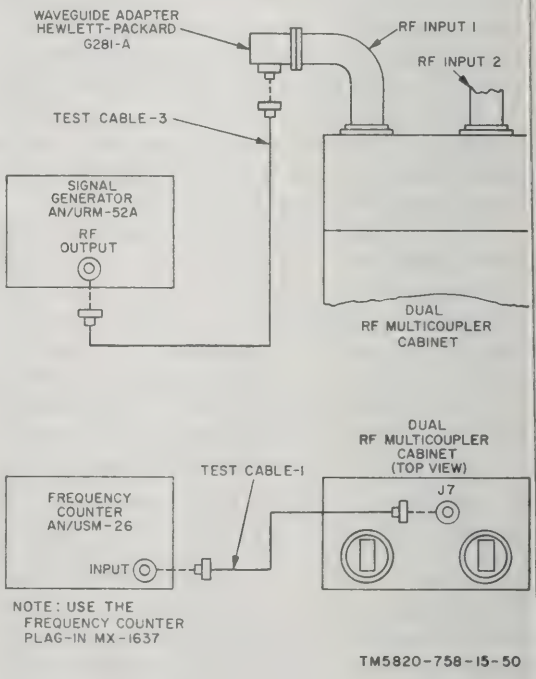


Figure 2–15. RF generator stability, test setup.

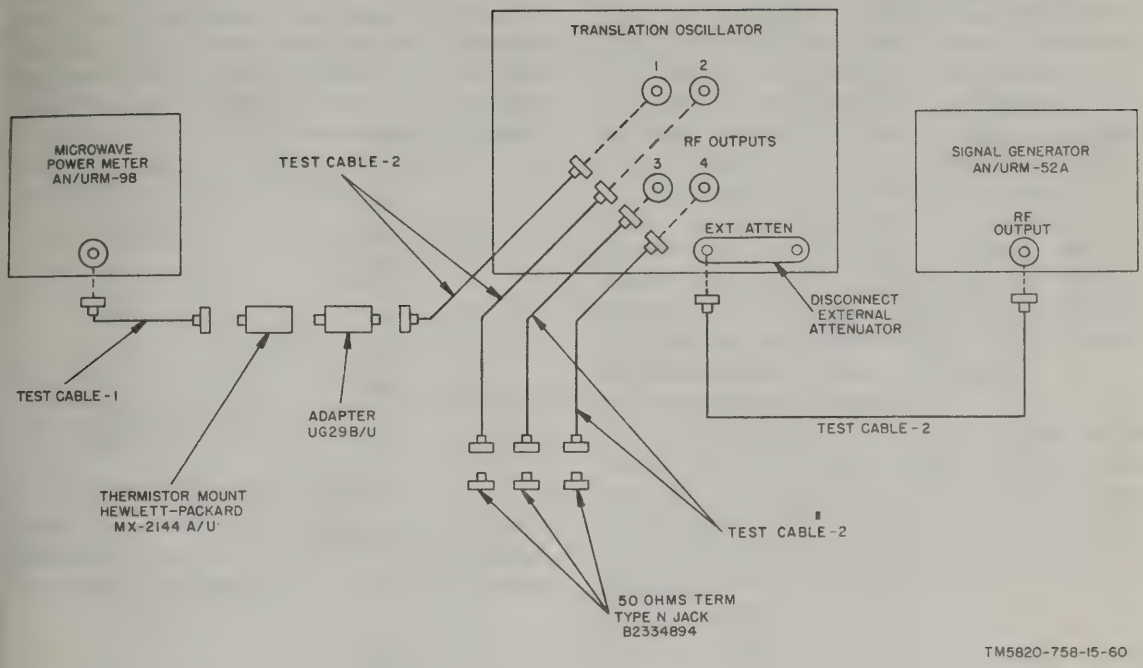


Figure 2-14. Translation oscillator power output measurement, test setup.

drawer since the multicoupler amplifier requires 15-volt direct current (dc) power from the drawer. Be certain that a 75-ohm termination is connected to the output tee-connector of the multicoupler amplifier. Proceed with the response test as follows:

(1) Adjust the AN/USM-196 controls as follows:

Control	Setting
MODE SELECTOR	CHOPPED
GAIN (A&B)	0.1V/CM or as required
POLARITY (A&B)	POSITIVE
INPUT (A&B)	DC

(2) Adjust the AN/USM-196 controls for a display as shown by waveform A, figure 2-17. Align the channel A track with the top of the response display. Adjust the marker, at a convenient amplitude, to the center frequency, and check the center of the response.

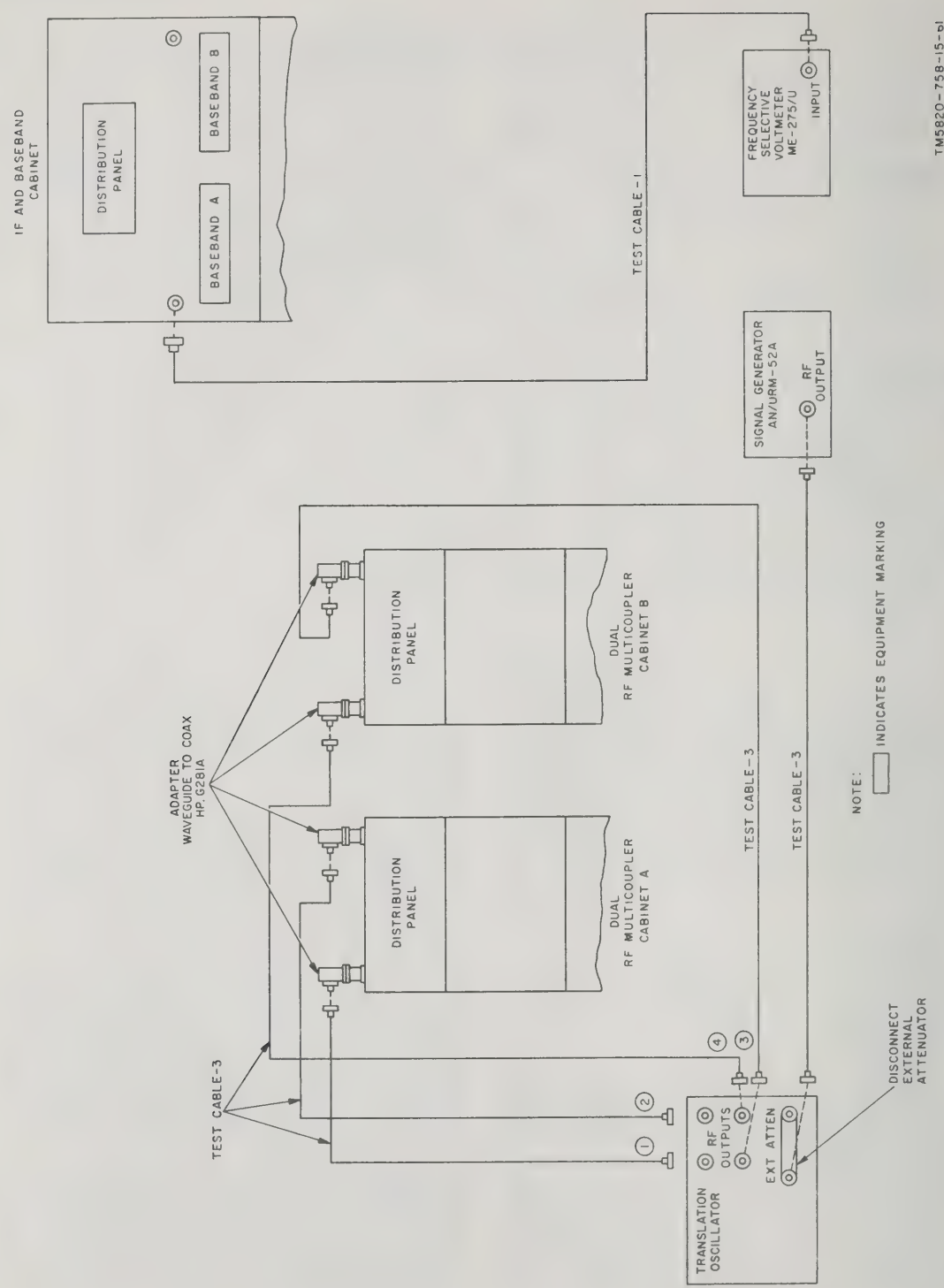
(3) Insert 3-db attenuation at Sweep Generator SG-367/U (sweep generator) and adjust the marker trace (channel A) to the top of the attenuated response. See waveform figure 2-17. The marker should be temporarily removed for this adjustment. Remove the 3-db attenuation.

(4) Vary the marker between the lower and upper 3-dbm points F_1 and F_2 and check the symmetry of the response around F_o.

(5) Set the peak of the response curve to a convenient reference line.

(6) Insert 3 db of attenuation, and note the amplitude of the response peak shown by waveform B, figure 2-17. Position the channel A trace to the top of this peak. Attenuate the marker on trace A until trace A adjustment is made, then insert the marker on trace A.

(7) Remove the 3-db attenuation. Decrease the frequency of the SG-309/FRC-47 until the frequency marker coincides with the lower 3-db point, F_1. Measure this frequency, with the frequency counter, and record. It should be F_o -100 ±5kHz.


IF AND BASEBAND CABINET
DISTRIBUTION PANEL
BASEBAND A
BASEBAND B
TEST CABLE-1
FREQUENCY SELECTIVE VOLTMETER ME-275/U
INPUT
SIGNAL GENERATOR AN/URM-52A
RF OUTPUT
ADAPTER WAVEGUIDE TO COAX HP.G281A
DISTRIBUTION PANEL
DUAL RF MULTICOUPLER CABINET B
DISTRIBUTION PANEL
DUAL RF MULTICOUPLER CABINET A
TEST CABLE-3
TEST CABLE-3
TEST CABLE-3
TRANSLATION OSCILLATOR
RF OUTPUTS
EXT ATTEN
DISCONNECT EXTERNAL ATTENUATOR
NOTE:
INDICATES EQUIPMENT MARKING
TM5820-758-15-81

(8) Increase the frequency of the SG–309/FRC–47 until the frequency marker coincides with the upper 3–db point, F_2. Measure this frequency, with the frequency counter, and record it. It should be $F_0 \pm 100$ kHz. Calculate the bandwidth, and record it. The center is specified as FO. The assigned tributary channel center frequencies are given in the chart below.

Tributary Channel	Center frequency (MHz)
One	69.8
Two	71.0
Three	69.0
Four	71.4
Five	70.2
Six	68.6
Seven	69.4
Eight	70.6

2–14. Alarm Checkout Procedures

These procedures verify that the central alarm equipment on CEC cabinet B is functional. These alarm indications are provided as inputs to cabinet B and are derived locally in each of the transmitters, power amplifiers, receivers, power supplies, deicers, and dehydrators that are monitored by the alarm equipment. The central equipment alarms include visual (lamps) and audible (bell) indications and a summary alarm signal that is sent to the maintenance control center. The tests in *a* through *d* below verify the functional operation of these alarm circuits and presume that the equipments are in their normal operating modes with the waveguides connected to their respective site antennas. Detailed descriptions of individual equipment alarms are contained in the associated equipment manuals.

a. Transmitter Alarms.

(1) On the front panel of transmitter cabinet. A modulator-exciter drawer, disconnect the cable from the BASEBAND IN connector. The XMTR A switch-indicator (on central equipment alarm panel) should light red, and the alarm bell should ring.

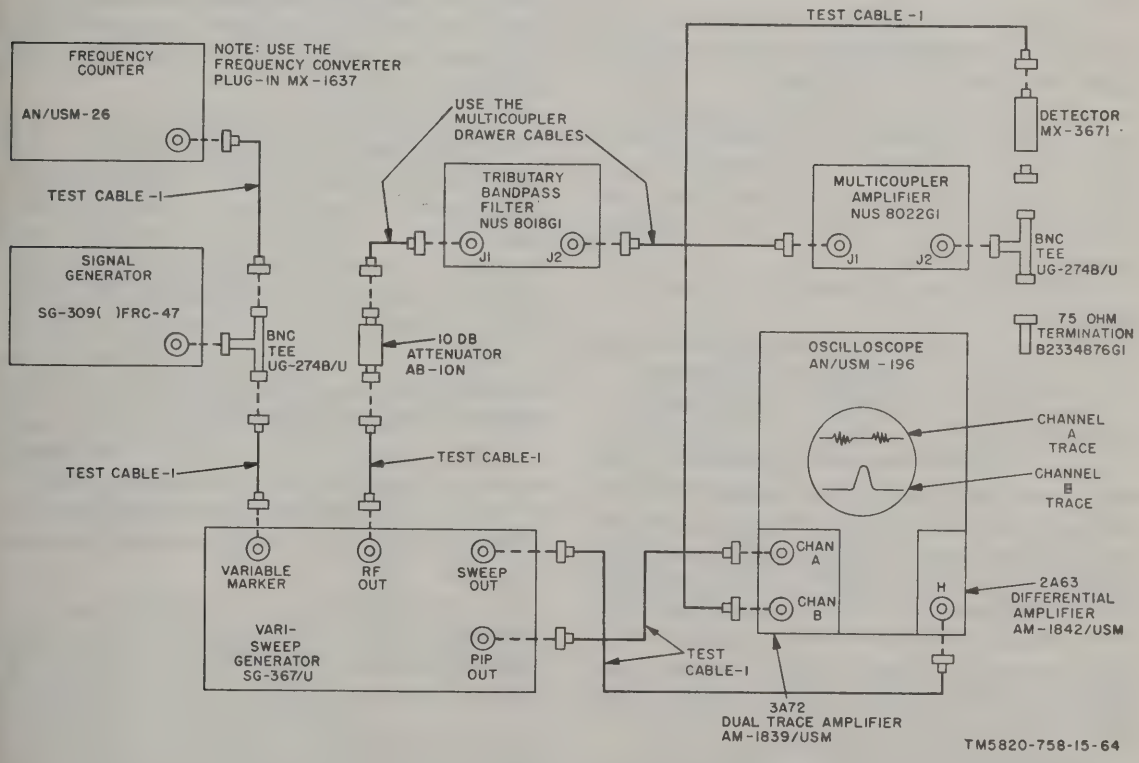


Figure 2–16. Filter bandwidth test setup.

(2) On the front panel of CEC cabinet B, press the XMTR A switch-indicator. The switch-indicator should change from red to amber, and the alarm bell should be silenced.

(3) Reconnect the cable disconnected in (1) above. The XMTR A switch-indicator should light green, and the alarm bell should ring.

(4) Press the XMTR A switch-indicator. The switch-indicator should go out, and the alarm bell should be silenced.

(5) Disconnect the cable from the BASE-BAND IN connector on the front panel of the transmitter cabinet B modulator-exciter drawer. The XMTR B switch-indicator should light red, and the alarm bell should ring.

(6) Press the XMTR B switch indicator. The switch-indicator should change from red to amber, and the alarm bell should be silenced.

(7) Reconnect the cable disconnected in (5) above. The XMTR B switch indicator should light green, and the alarm bell should ring.

(8) Press the XMTR B switch-indicator. The switch indicator should go out, and the alarm bell should stop ringing.

(9) In transmitter cabinet A, open the power supply drawer and set the 800–volt switch to STANDBY. On the CEC, the XMTR A indicator should light red. Reset the 800–volt switch to NORMAL. The CEC indicator should go out.

(10) Repeat the procedure in (9) above for transmitter B.

b. Power Amplifier Alarms. If power amplifiers are used, perform the following:

(1) Verify that all RF connections are properly made.

(2) On power amplifier cabinet A, depress the BEAM SWITCH. The CEC POWER AMPL A indicator should turn green after the beam voltage comes to 7,500 volts and the LOW RF indicator on the power amplifier turns green after the beam voltage comes to 7,500 volts and the LOW RF indicator on the power amplifier turns green. Depress the POWER AMPL A indicator to turn its green light out and silence the bell.

(3) On power amplifier cabinet A, disconnect the RF input cable from the top of the cabinet. The POWER AMPL A indicato on the CEC should turn red and the be should ring. Reconnect the RF input cable t the power amplifier to silence the bell an turn out the red light. Depress the BEAM SWITCH to place the power amplifier i standby.

(4) Repeat the procedures in (2) and (3) above for power amplifier cabinet B.

c. Receiver Alarms.

(1) Place transmitter cabinet A in the standby mode of operation, and connect equipment as shown in figure 2–18.

(2) Connect the AN/USM–26 to the IF OUTPUT 1 jack on the preselector and mixer drawer of rf multicoupler cabinet A as shown in figure 2–7.

(3) Insert the correct crystal in the translation oscillator for the tributary one channel, and adjust the translation oscillator for this crystal.

(4) Turn on transmitter cabinet A, and adjust the test setup Variable Attenuator CN–1095/G to obtain a frequency counter lock-in. The Frequency counter will indicate 69.8 MHz (tributary one IF).

(5) Connect the test leads from the input of the frequency selective voltmeter to the XMT MON jack on the CEC cabinet A patch panel. Set the controls to the following positions: LINE IMPEDANCE switch to 600 ohms, FUNCTION SELECTOR switch to SEL VM 250 CYCLES, and ATTENUATOR DBM volts switch to 0.03–volt position. Calibrate the ME–275 as described in the instruction manual. Tune the frequency dial to peak the meter reading (approximately 4 kHz).

(6) Adjust the 4–kHz ADJ potentiometer on the tone generator module on shelf F of CEC cabinet B to obtain a reading of 24 millivolts (mv) on the frequency selective voltmeter.

(7) Disconnect the test leads from the MON jack on the CEC cabinet A, and connect them to the RCVR–MON jack for the tributary one on the CEC cabinet A patch panel. Adjust the variable attenuator in the test setup until the frequency selective voltmeter indicates 84 mv. All receiver alarm indicators in

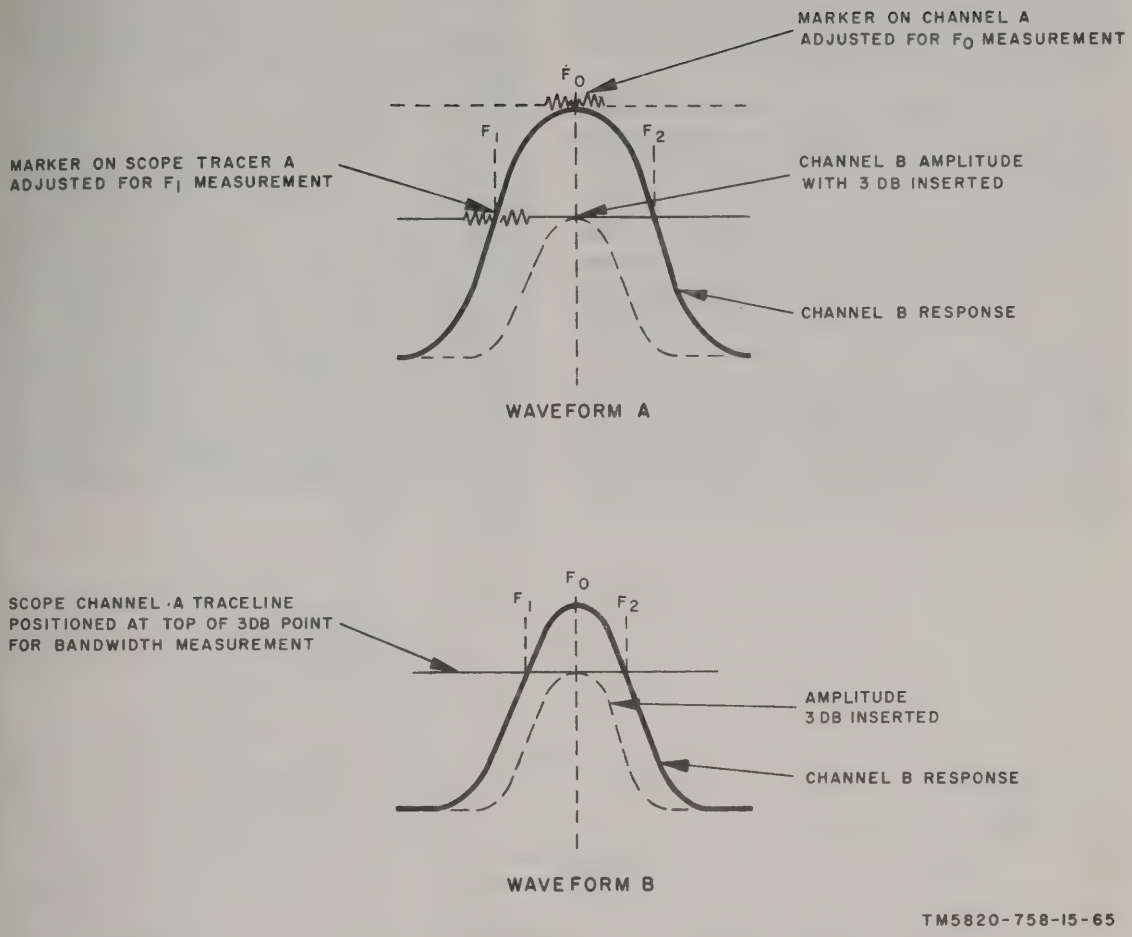


Figure 2-17. Filter response waveforms.

the CEC cabinet B alarm panel should be green showing the presence of the IF and pilot tone signals.

(8) Set all CEC switching units to the following positions: PRIORITY switch to A position; AUTO–MAN switch to AUTO position.

(9) Remove the cable from the IF INPUT 1 jack on the upper IF and baseband drawer of the tributary one IF and baseband cabinet. The I.F. & B.B. 1 lens on the CEC alarm panel should light red.

(10) Reconnect the cable removed in (9) above. The lens indicator shall become green.

(11) Set the PRIORITY switch on the tributary one switching unit, on shelf C of CEC cabinet A, to the B position.

(12) Remove the cable from the IF INPUT 1 jack on the lower IF and baseband drawer of the tributary one IF and baseband cabinet. The I.F & B.B. 1 lens on the CEC alarm panel should become red.

(13) Reconnect the cable removed in (12) above. The lens indicator shall become green.

(14) Set the PRIORITY switch on the tributary one switching unit to the A position.

(15) Disconnect cable W1 inside the parametric amplifier drawer of the dual RF multicoupler A cabinet. The R.F. MCPLR A lens on the CEC alarm panel should become red and the alarm bell should ring.

(16) Depress the lighted R.F. MCPLR A switch on the CEC. The red indication shall change to amber, and the alarm bell shall stop ringing.

(17) Reconnect the cable removed in (15) above. The R.F. MCPLR A lens should become green, and the alarm bell shall ring. Depress the R.F. MCPLR A switch to stop the alarm bell.

(18) Repeat the procedures in (15) through (17) above for the parametric amplifier installed in dual rf multicoupler cabinet B while observing the alarm indications on R.F. MCPLR B lesn on the CEC alarm panel. For nodal point radio sets that do not incorporat the parametric amplifiers, test procedures i (15) through (17) above are accomplished b removing the power input to the RF multi coupler drawer in place of disconnecting cabl W1.

(19) Repeat the entire alarm test procedur for each of the tributary channels installed i the nodal point radio set van; for each tribu tary channel the proper crystal must be in stalled in the translation oscillator, the norma input IF and pilot tone signals must be ob tained on the tributary channel, and the alarm conditions must be simulated as specified i the tests in (9) through (13) above. (Refer t paragraph 2–13*g*(8) for tributary IF's.) Th multicoupler alarm tests specified in (15) through (18) above is done only once sinc all tributary channels use the common multi coupler drawers.

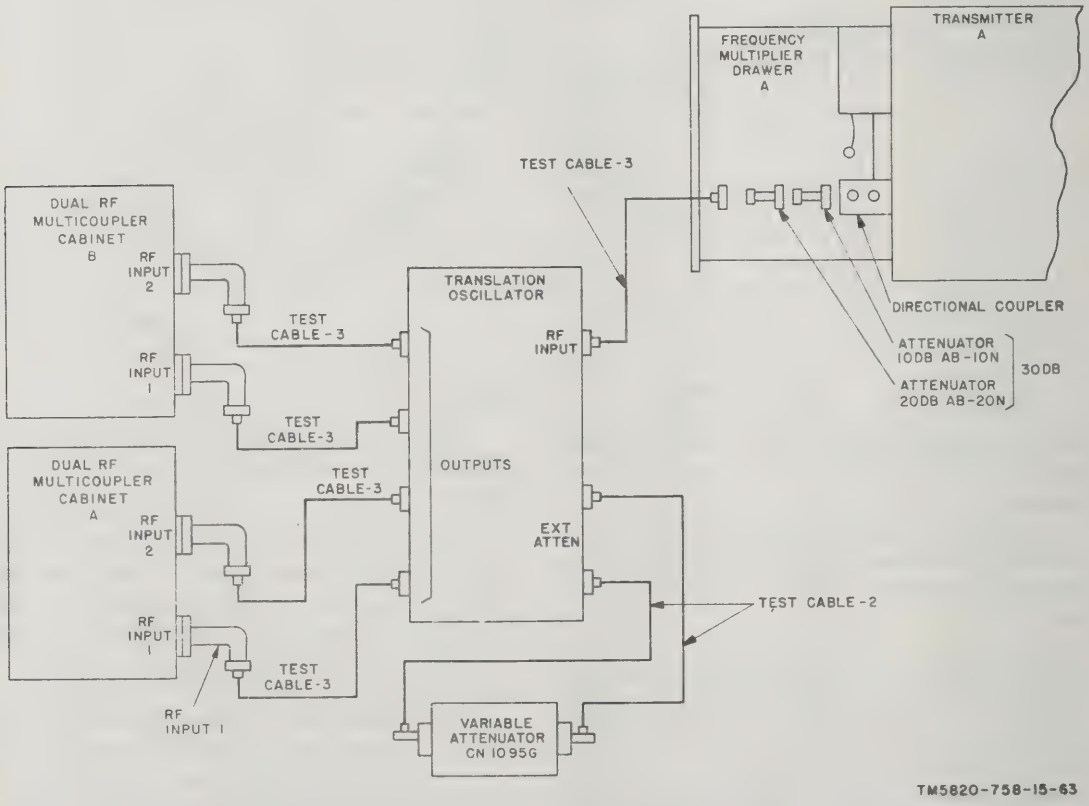


Figure 2–18. Receiver alarms checkout, test setup.

d. Auxiliary Alarms.

(1) The VSWR monitor alarms were checked during their alignment.

(2) The dehydrator alarm may be checked by turning off circuit breaker CB55 in utility power box 4. The CEC DEHYDRATOR indicator should turn red and then become green when CB55 is turned on.

(3) The deicer module alarm may be checked by turning off CB12 in utility power box 3. The CEC alarm panel SUMMARY DEICER indicator should turn red and then become green when CB12 is turned back on. When deicer switch S1 on the deicer monitor panel is turned off, no alarm should result. Reset S1 to ON.

(4) The power supply alarms can be checked by placing their individual POWER ON–OFF switches to OFF. The power supplies in levels C, D, E and F of central equipment cabinet A, are indicated by the POWER SUP 1–4 lens indicator. The power supplies in levels J, K, L and M are indicated by the POWER SUP 5–8 lens indicator. These will become red upon sensing a power supply failure and ring the alarm bell. Pressing the lighted switch will cause an amber indication and silence the bell. Restoring the failed power supply to normal operation will cause a green indication.

(5) The carrier channel power supplies in levels G and J of CEC cabinet B are indicated by the P.S. CARR CHAN lesn indicator. These can be tested the same as the power supplies in (4) above.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

3-1. General

Improper setting of controls may cause improper operation or faulty test indications. It is important to know the function of every control before operation or alignment of the equipment is attempted. The functions of controls and indicators of those equipments not covered by the publications listed in paragraph 1-5 are described in this section.

3-2. Equipment Power Box 1, Controls

The controls provided on equipment power box 1 are shown in figure 3-1 and described in the chart below.

Panel designation and reference symbol	Function
CB1 MAIN	Circuit breaker that applies 208-volt, 3-phase ac power to CB2 through CB15.
CB2	Circuit breaker that applies 208-volt, 3-phase ac power to power amplifier cabinet A (when used).
CB3	Circuit breaker that applies 115-volt ac power to vswr module A (used in 1-watt configuration only).
CB4	Circuit breaker that applies 115-volt ac power to dual RF multicoupler cabinet A.
CB5	Circuit breaker that applies 115-volt power to transmitter cabinet A.
CB8.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 1, power supply A.
CB8.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 2, power supply A.
CB9.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 3, power supply A.
CB9.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 4, power supply A.
CB10.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 5, power supply A.
CB10.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 6, power supply A.
CB11.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 7, power supply A.
CB11.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 8, power supply A.
CB14	Circuit breaker that applies 115-volt ac power to central equipment cabinet A, circuit 1.
CB15	Circuit breaker that applies 115-volt ac power to central equipment cabinet B, circuit 1.

3-3. Equipment Power Box 2, Controls

The controls provided on equipment power box 2 are shown in figure 3-2 and are described in the chart below.

Panel designation and reference symbol	Function
CB17 MAIN	Circuit breaker that applies 208-volt, 3-phase ac power to CB18 through CB31.
CB18	Circuit breaker that applies 208-volt, 3-phase ac power to power amplifier cabinet B (when used).
CB19	Circuit breaker that applies 115-volt ac power to vswr module B (used in 1-watt configuration only).
CB20	Circuit breaker that applies 115-volt ac power to dual RF multicoupler cabinet B.
CB21	Circuit breaker that applies 115-volt ac power to transmitter cabinet B.
CB24.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 1, power supply B.
CB24.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 2, power supply B.
CB25.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 3, power supply B.
CB25.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 4, power supply B.
CB26.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 5, power supply B.
CB26.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 6, power supply B.
CB27.1	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 7, power supply B.
CB27.2	Circuit breaker that applies 115-volt ac power to dual IF and baseband cabinet for tributary 8, power supply B.
CB30	Circuit breaker that applies 115-volt ac power to central equipment cabinet A, circuit 2.
CB31	Circuit breaker that applies 115-volt ac power to central equipment cabinet B, circuit 2.

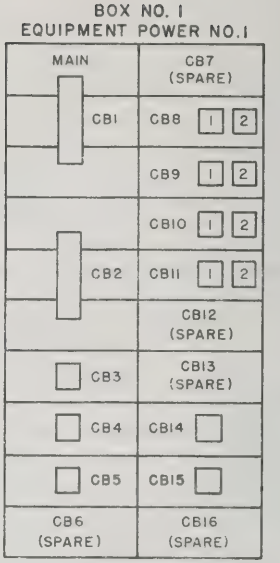


Figure 3–1. Equipment power box 1, controls.

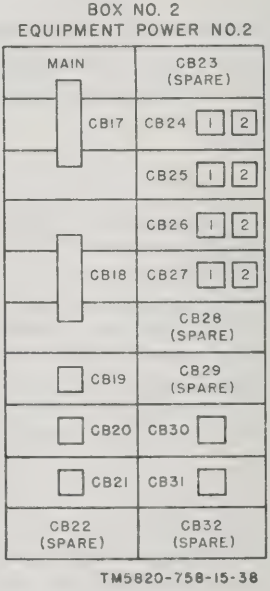


Figure 3–2. Equipment power box 2, controls.

3–4. Utility Power Box 3, Controls

The controls provided on utility power box 3 are shown in figure 3–3 and are described in the following chart.

Panel designation and reference symbol	Function
CB33 MAIN	Circuit breaker that applies 208-volt, 3-phase ac power to CB34 through CB44.2 in utility power box 3.
CB34	Circuit breaker that applies 208-volt, 3-phase ac power to air conditioner 1.
CB39	Circuit breaker that applies 115-volt ac power to van dome lights DS1, DS3, DS5, DS7, DS9, DS11, DS13, DS15, DS17, and DS19 via light switches S1 and S3.
CB41.1	Circuit breaker that applies 115-volt ac power to deicers 1A and 2A.
CB41.2	Circuit breaker that applies 115-volt ac power to deicers 1B and 2B.
CB42.1	Circuit breaker that applies 115-volt ac power to deicers 3A and 4A.
CB42.2	Circuit breaker that applies 115-volt ac power to deicers 3B and 4B.
CB43.1	Circuit breaker that applies 115-volt ac power to deicers 5A and 6A.
CB43.2	Circuit breaker that applies 115-volt ac power to deicers 5B and 6B.
CB44.1	Circuit breaker that applies 115-volt ac power to deicers 7A and 8A.
CB44.2	Circuit breaker that applies 115-volt ac power to deicers 7B and 8B.

3-5. Utility Power Box 4, Controls

The controls provided on utility power box 4 are shown in figure 3-4 and are described in the chart below.

Panel designation and reference symbol	Function
CB46 MAIN	Circuit breaker that applies 208-volt, 3-phase ac power to CB47 through CB55 in utility power box 4.
CB47	Circuit breaker that applies 208-volt, 2. 3-phase ac power to air conditioner
CB52	Circuit breaker that applies 208-volt ac power to air conditioner 3.
CB53	Circuit breaker that applies 115-volt ac power to van receptacles J5, J36, J37, and J54.
CB54	Circuit breaker that applies 115-volt ac power to even-numbered dome lights DS2 through DS18 via van light switches S2 and S4.
CB55	Circuit breaker that applies 115-volt ac power to waveguide pressurizer dehydrator.

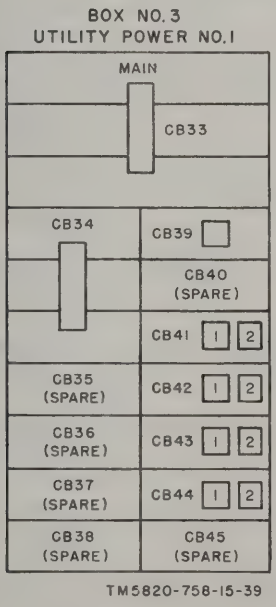


Figure 3-3. Utility power box 3, controls.

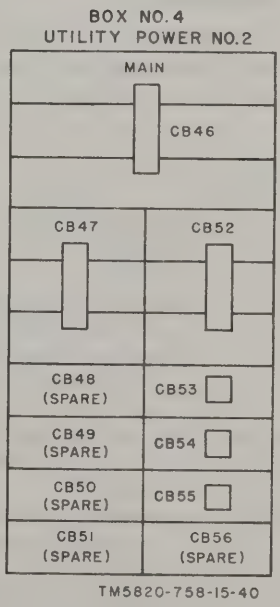


Figure 3-4. Utility power box 4, controls.

3-6. Van Light Switches

Four van light switches control the two rows of dome lights in the ceiling of the van. A pair of switches is located adjacent to the curbside and rear doors of the van. One switch of either pair controls the roadside row of lights, while the other switch controls the curbside row of lights. A description of these switches is given in the chart below.

Panel description	Reference symbol	Function
Van lights switch (not labeled).	S1	Single-pole, double-throw toggle switch that applies 115-volt ac power to odd-numbered dome lights.
Van lights switch (not labeled).	S2	Single-pole, double-throw toggle switch that applies 115-volt ac power to even-numbered dome lights.
Van lights switch (not labeled).	S3	Single-pole, double-throw toggle switch that applies 115-volt ac power to odd-numbered dome lights.
Van lights switch (not labeled).	S4	Single-pole, double-throw toggle switch that applies 115-volt ac power to even-numbered dome lights.

3-7. Deicer Control and Alarm Assembly, Controls and Indicators

The controls and indicators provided on the deicer control and alarm assembly are shown in figure 3-5 and are described in the chart below.

Panel description	Reference symbol	Function
DE-ICER 1A-2A ON/OFF.	S1	Energizes deicers 1A and 2A and their alarm indicators.
DE-ICER 1B-2B ON//OFF	S2	Energizes deicers 1B and 2B and their alarm indicator
DE-ICER 3A-4A ON/OFF	S3	Energizes deicers 3A and 4A and their alarm indicators.
DE-ICER 3B-4B ON/OFF	S4	Energizes deicers 3B and 4B and their alarm indicators.
DE-ICER 5A-6A ON/OFF.	S5	Energizes deicers 5A and 6A and their alarm indicators.
DE-ICER 5B-6B ON/OFF.	S6	Energizes deicers 5B and 6B and their alarm indicators.
DE-ICER 7A-8A ON/OFF.	S7	Energizes deicers 7A and 8A and their alarm indicators.
DE-ICER 7B-8B ON/OFF.	S8	Energizes deicers 7B and 8B and their alarm indicators.
DE-ICER 1A-2A ON.	DS1	Red-jeweled indicator light to indicate DE-ICER 1A-2A ON/OFF switch S1 is in ON position.
DE-ICER 1B-2B ON.	DS2	Red-jeweled indicator light to indicate DE-ICER 1B-2B ON/OFF switch S2 is in ON position.
DE-ICER 3A-4A ON.	DS3	Red-jeweled indicator light to indicate DE-ICER 3A-4A ON/OFF switch S3 is in ON position.
DE-ICER 3B-4B ON.	DS4	Red-jeweled indicator light to indicate DE-ICER 3B-4B ON/OFF switch S4 is in ON position.
DE-ICER 5A-6A ON.	DS5	Red-jeweled indicator light to indicate DE-ICER 5A-6A ON/OFF switch S5 is in ON position.
DE-ICER 5B-6B ON.	DS6	Red-jeweled indicator light to indicate DE-ICER 5B-6B ON/OFF switch S6 is in ON position.
DE-ICER 7A-8A ON.	DS7	Red-jeweled indicator light to indicate DE-ICER 7A-8A ON/OFF switch S7 is in ON position.
DE-ICER 7B-8B ON.	DS8	Red-jeweled indicator light to indicate DE-ICER 7B-8B ON/OFF switch S8 is in ON position.
DE-ICER 1A/2A ALARM.	XDS9	Dual indicator lights red when deicer 1A or 2A fails.
DE-ICER 1B/2B ALARM	XDS10	Dual indicator lights red when deicer 1B or 2B fails.
DE-ICER 3A/4A ALARM.	XDS11	Dual indicator lights red when deicer 3A or 4A fails.
DE-ICER 3B/4B ALARM.	XDS12	Dual indicator lights red when deicer 3B or 4B fails.
DE-ICER 5A/6A ALARM.	XDS13	Dual indicator lights red when deicer 5A or 6A fails.
DE-ICER 5B/6B ALARM.	XDS14	Dual indicator lights red when deicer 5B or 6B fails.

Panel designation	Reference symbol	Function
DE-ICER 7A/8A ALARM	XDS15	Dual indicator lights red when deicer 7A or 8A fails.
DE-ICER 7B/8B ALARM.	XDS16	Dual indicator lights red when deicer 7B or 8B fails.

Note. For each nodal point radio set van configuration, deicer alarm indicators XDS9 through XDS16 are either supplied or replaced by indicators marked NOT EQUIP'D according to the following chart.

Indicator	Quantity of each indicator supplied with nodal point radio set NUS 6260G					
	1	5	13	22	24	25
DE-ICER 1A ALARM	1	1	1	1	1	1
DE-ICER 2A ALARM	1	1	1	1	1	1
DE-ICER 1B ALARM	1	1	1	1	1	1
DE-ICER 2B ALARM	1	1	1	1	1	1
DE-ICER 3A ALARM	1	1	1	1	1	0
DE-ICER 4A ALARM	1	1	1	0	0	0
DE-ICER 3B ALARM	1	1	1	1	1	0
DE-ICER 4B ALARM	1	1	1	0	0	0
DE-ICER 5A ALARM	1	1	1	0	0	0
DE-ICER 6A ALARM	1	1	0	0	0	0
DE-ICER 5B ALARM	1	1	1	0	0	0
DE-ICER 6B ALARM	1	1	0	0	0	0
DE-ICER 7A ALARM	1	1	0	0	0	0
DE-ICER 8A ALARM	1	0	0	0	0	0
DE-ICER 7B ALARM	1	1	0	0	0	0
DE-ICER 8B ALARM	1	0	0	0	0	0
NOT EQUIP'D	0	2	6	10	10	12

3-8. Vswr Monitor Alarm Module, Control

The only front panel control on the vswr monitor alarm module is ON/OFF switch S1 (fig. 1-6), which is a pushbutton switch that resets the vswr monitor alarm module for normal operation.

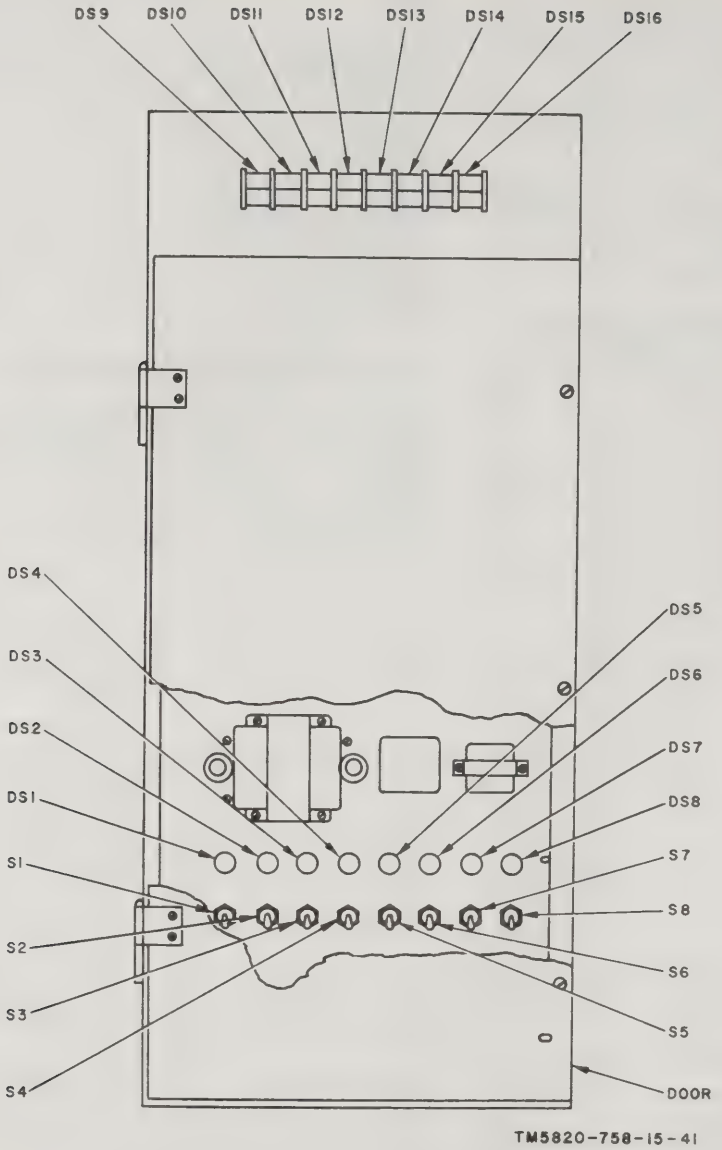


Figure 3-5. Deicer control and alarm assembly, controls and indicators.

Section II. OPERATION UNDER USUAL CONDITIONS

3-9. General

This section provides turn-on, operating, and turn-off procedures for the nodal point radio set, the deicer monitor, and the vswr monitors. Since the nodal point radio set, deicer module, and vswr monitors operate automatically and continuously after turn-on, operating proce-

dures are restricted to the use of the nodal point radio set orderwire facilities.

3-10. Equipment Turn-On

a. Nodal Point Radio Set Turn-On. The nodal point radio set is to be brought to the standby power condition when the requirements of initial installation (chapter 2) have been satisfied. To place the nodal point radio set in operation at the start of link operations, perform the following:

(1) As soon as the link signal activates the alarm bell in the central equipment, acknowledge the change in the status of R.F. MCPLR A, R.F. MCPLR B, and I.F. and B.B. 1 through I.F. and B.B. 8, as applicable, by depressing each indicator. The receiver is now operating and link tests may be made in accordance with system procedures.

(2) If power amplifiers are used, depress the BEAM SWITCH in each power amplifier. When the power has reached a level sufficient to turn off the LOW RF light on each power amplifier, acknowledge the change in status on central equipment cabinet B by depressing the POWER AMPL A and B indicators.

b. Deicer Control and Alarm Assembly Turn-On. With power turned on at power distribution box 3, the deicer control and alarm assembly is turned on by setting the appropriate DE-ICER ON/OFF switches to the ON position. The deicer is to be used only when the outside temperature is between +35°F and ±15°F. Check that the associated DE-ICER ON indicator lights as each switch is set to ON.

c. Vswr Monitor Alarm Modules Turn-On. Vswr monitor alarm modules A and B are used in 1-watt nodal point radio sets only. With power turned on at power distribution boxes 1 and 2, each vswr monitor alarm module is ready for operation when its reset pushbutton S1 is depressed.

3-11. Operating Nodal Point Radio Set Orderwire Facilities

Central equipment cabinet B is equipped to communicate with all other vans, shelters, or sites. Order wire calls to or from the tributary sites may be originated or accepted directly at the nodal point radio set and vans or shelters at the same or other mainline sites are processed by the maintenance control center (MCC). The MCC is signaled by the nodal point radio set by a switch closure signal. This switch, S1, is in the middle of the patch panel of central equipment cabinet B. (The maintenance control center has facilities for establishing conference calls with a maximum of 12 parties.) Incoming calls from the maintenance control center are signaled by a buzzer and the INCOMING CALL indicator on the 1.6-kHz tone receiver adjacent to the four-wire telephone unit in central equipment cabinet B. The procedures for initiating or acknowledging tributary calls are given in *a* and *b* below.

a. Initiating Tributary Call. Orderwire calls from the radio set are transmitted to all tributary sites in the sector on a party line basis, with simultaneous signaling at each tributary. Selective tributary signaling is accomplished by coded ringing. The desired tributary is selected at the select panel on central equipment cabinet B and monitored in the nodal point radio set van. Before operating the select panel, note the status of the IN USE indicator. This indicator lights amber when the maintenance control center is utilizing a tributary circuit. The tributary circuits are available at the nodal point radio set when the IN USE indicator is out. To initiate a call to a tributary, proceed as follows:

(1) On the select panel, depress the switch-indicator associated with the tributary being called. (The switch-indicator lights white when depressed; the IN USE indicator lights blue.)

(2) Lift the handset from the cradle on the four-wire telephone unit, and momentarily depress the signaling pushbutton on the handset. Wait for acknowledgement.

(3) Upon completion of call, return the handset to the cradle, and depress the RESET pushbutton on the select panel. The lighted indicators go out.

b. Acknowledging Tributary Call. An incoming tributary call from only one tributary may be received at one time, and its circuit

must be manually selected by use of the select panel in central equipment cabinet B. The incoming tributary call may be acknowledged at the maintenance control central also. In the nodal point radio set, the incoming tributary call causes an associated switch-indicator on the select panel to light white. Also, a buzzer sounds and the INCOMING CALL indicator on the related kHz tone receiver in central equipment cabinet A lights. To acknowledge the call, proceed as follows:

(1) Depress lighted switch-indicator on select panel. (The switch-indicator lights blue when depressed; the IN USE indicator lights blue.)

(2) Lift the handset from the cradle, and identify yourself.

(3) Upon completion of call, return handset to cradle and depress RESET push-button on select panel. The lighted indicators go out.

3–12. Equipment Turn-Off

a. Deicer Control and Alarm Assembly Turn-Off. The deicer control and alarm assembly is turned off by setting the DE-ICER ON/OFF switches to the OFF position. The associated DE-ICER ON indicator light will go off as each switch is set to OFF.

b. Vswr Monitor Alarm Modules Turn-Off. Vswr monitor alarm modules A and B, used in 1-watt nodal point radio sets only, are turned off by setting circuit breaker CB3 in power distribution box 1 and circuit breaker CB19 in equipment power box 2 to their OFF positions. The vswr monitor alarm module should be turned off for maintenance of this module only or when the entire equipment complement of the van is turned off.

c. Nodal Point Radio Set Turn-Off. Except when extensive maintenance is required, the nodal point radio set is in continuous operation. Turn off the nodal point radio set as follows:

(1) If power amplifiers are used, turn them off first by following (*a*) through (*c*) below.

(*a*) Depress the BEAM SWITCH on each power amplifier.

(*b*) Depress the MAIN POWER SWITCH on each power amplifier. The switches should change from green to white.

(*c*) After 2 to 3 minutes the blowers should shut down. Rotate the BEAM VOLTAGE ADJ control fully counterclockwise.

(2) If power amplifiers are not used, or after they are shut down if used, the nodal point radio set may be shut down by turning off all the circuit breakers in all four power boxes, commencing with the highest numbered breakers and ending with breaker CB1.

(3) The van may be closed and locked if desired. If the van is to be left closed for an extended period of time, do not turn off the van dome lights. The heat generated by the light prevents the accumulation of moisture and resulting condensation on the equipment.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3–13. General

a. The nodal point radio set is capable of operating in extremely cold or hot climates. The nodal point radio set van provides complete protection from the elements for equipment and personnel; however, when the signal and power entry panels are exposed to adverse weather conditions, special precautionary measures are required. These measures are described in paragraph 3–14.

b. The nodal point radio set is also capable of providing partial operation in the event of an equipment failure. Partial operation is described in paragraph 3–15.

3–14. Operation Under Adverse Weather Conditions

a. Cold Climates. Extreme cold causes cables and wires to become hard, brittle, and difficult to handle. Use care when handling cables and wires and when making connections to avoid kinks and unnecessary loops. Make certain that plugs, receptacles, and feedthrough fittings on the outside of the van are free of

frost, snow, or ice by replacing the appropriate seals and covers on the plugs, receptacles and feedthrough fittings when they are not in use. Also cover the signal and power entry panels when they are not in use. Replace plug, receptacle, and feedthrough fitting seals and covers as soon as they are disconnected. Never drag or place an open plug in the snow.

b. Hot, Dry Climates. In hot, dry climates the plugs, receptacles, and feedthrough fittings are subject to damage from dirt and dust. Cover the signal and power entry panels when they are not in use, and replace the seals and covers on the plugs, receptacles, and feedthrough fittings. Never drag an open plug along the ground.

c. Warm, Damp Climates. In warm, damp climates, the equipment is subject to damage from moisture and fungi. Wipe all moisture and fungi from the equipment with a lint-free cloth.

3-15. Partial Operation

a. Transmitting Equipment.

(1) *Transmitter malfunctions.* In 1-watt nodal point radio set vans, a malfunction in the modulator of one transmitter results in an automatic switchover to the modulator in the second transmitter. In 1-kw vans, a malfunction in the modulator exciter or frequency multiplier drawer of one transmitter results in an automatic switchover to the second transmitter. In either case, communications are maintained until the defective unit is repaired and restored to normal operation.

(2) *Power amplifier malfunctions.* A failure in one power amplifier reduces transmission to single polarization. Communications can be maintained on this basis until the defective power amplifier is repaired and restored to normal operation.

b. Receiving Equipment. Since the receiving equipment consists of two complete quadruple-diversity receivers, a malfunction in one receiver will, at most, reduce reception to a dual-diversity basis. A malfunction in one of the dual RF multicoupler cabinets is a situation in which reduction of reception to a dual-diversity basis may occur. A malfunction in one of the drawers of a dual IF and baseband cabinet (tributary cabinet), however, will reduce reception of that particular tributary to a dual-diversity basis, but reception of all other serviced tributaries will remain on a quadruple-diversity basis. In either case, communications can be maintained until the defective equipment is repaired and restored to normal operation.

c. Prime Power Failure. A failure of one of the prime power sources requires that immediate action be taken in the van if power amplifiers are used ((1) through (3) below). Other equipment in the van is normally unaffected by power loss.

(1) The normal sequence of shutdown of power amplifiers requires a cooling period of 2 to 3 minutes of forced air. If this cooling period is cut off by power failure, damage to the klystron may result.

(2) Immediately after power failure, on the affected power amplifier, turn the BEAM SWITCH off and turn the BEAM VOLTAGE adjust control fully counterclockwise.

(3) At the time that prime power returns, on the affected power amplifier, after normal warmup time, depress the BEAM SWITCH. Observing the BEAM VOLTAGE meter and the BEAM CURRENT meter, carefully and slowly turn the BEAM VOLTAGE adjust control clockwise. At a beam voltage of 2,000 volts, wait 5 minutes, continue to raise the beam voltage until it reaches 4,000 volts, and wait 5 minutes. The beam current should be approximately 200 milliamperes (ma). Continue to raise the beam voltage until it reaches 6,000 volts. The beam current should not exceed 400 milliamperes at this time. Wait 10 minutes, and then raise the beam voltage to 7,500 volts. The beam current should not exceed 500 milliamperes. If it does, shut down the power amplifier and call for maintenance personnel to check for klystron damage.

CHAPTER 4

THEORY OF OPERATION

4–1. System Application

a. The deployment of a typical nodal point radio set van at a nodal point site is shown in figure 4–1. Equipment complement for the site consists of one nodal point radio set van, one console remote equipment, one multiplexer set, two radio equipment shelters, and one maintenance control center. Up to three nodal point radio set vans may be connected to the console remote equipment van; each nodal point radio set may service up to eight tributaries.

b. Two radio equipment shelters and the multiplexer set function as a through repeater site, with their antennas pointing toward neighboring mainline sites. The multiplexer set drops five dedicated channels, used throughout the ET–A console system, to voice frequency level and feeds them to the console remote equipment.

c. The console remote equipment operates automatically and is directed by signals from either a console operations center or a tributary site. The five channels, mentioned in *b* above, have one command and control supervisory channel and four voice traffic channels that carry the control signals and communications traffic to and from the local console sites and console remote equipments. The five channels from each direction of the mainline are bridged in the console remote equipment, thereby giving the switching circuits in this van uninterrupted connection to the mainline in both directions. The console remote equipment sends one transmit orderwire channel and one transmit carrier channel to the nodal point radio set van, which feeds a pair of antennas pointing in the direction of each tributary site. The console remote equipment receives up to eight tributary audio channels from the nodal point radio set van.

d. The console remote equipment, on receiving a command from the console local equipment on the command and control channel, connects the ready channel (the next available voice channel) to one of the transmit channels of the nodal point radio set. The nodal point radio set transmits this data to all equipped tributaries and rings only the called tributary. Voice traffic from a tributary is sent to the nodal point radio set and then to the console remote equipment on the tributary receive channel assigned to that tributary. The console remote equipment connects the voice traffic received from the tributary to the ready channel for transmission, via the multiplexer set and a radio equipment shelter to the console local equipment.

e. Orderwire channels from each direction of the mainline are dropped to the voice frequency level in the radio equipment shelters and sent to the maintenance control center. The maintenance control center may use the orderwire channels in either direction of the mainline, or they may be connected as a through circuit in both directions for conference purposes. The maintenance control center extends a local orderwire circuit to the multiplexer set, which can also be connected into the conference circuit. Local orderwire circuits are also extended to the console remote equipment and the nodal point radio set. Controls are provided at the maintenance control center and the nodal point radio set van for connecting the orderwire to any one of the tributaries. The maintenance control center can also connect the mainline orderwire with the tributary orderwire.

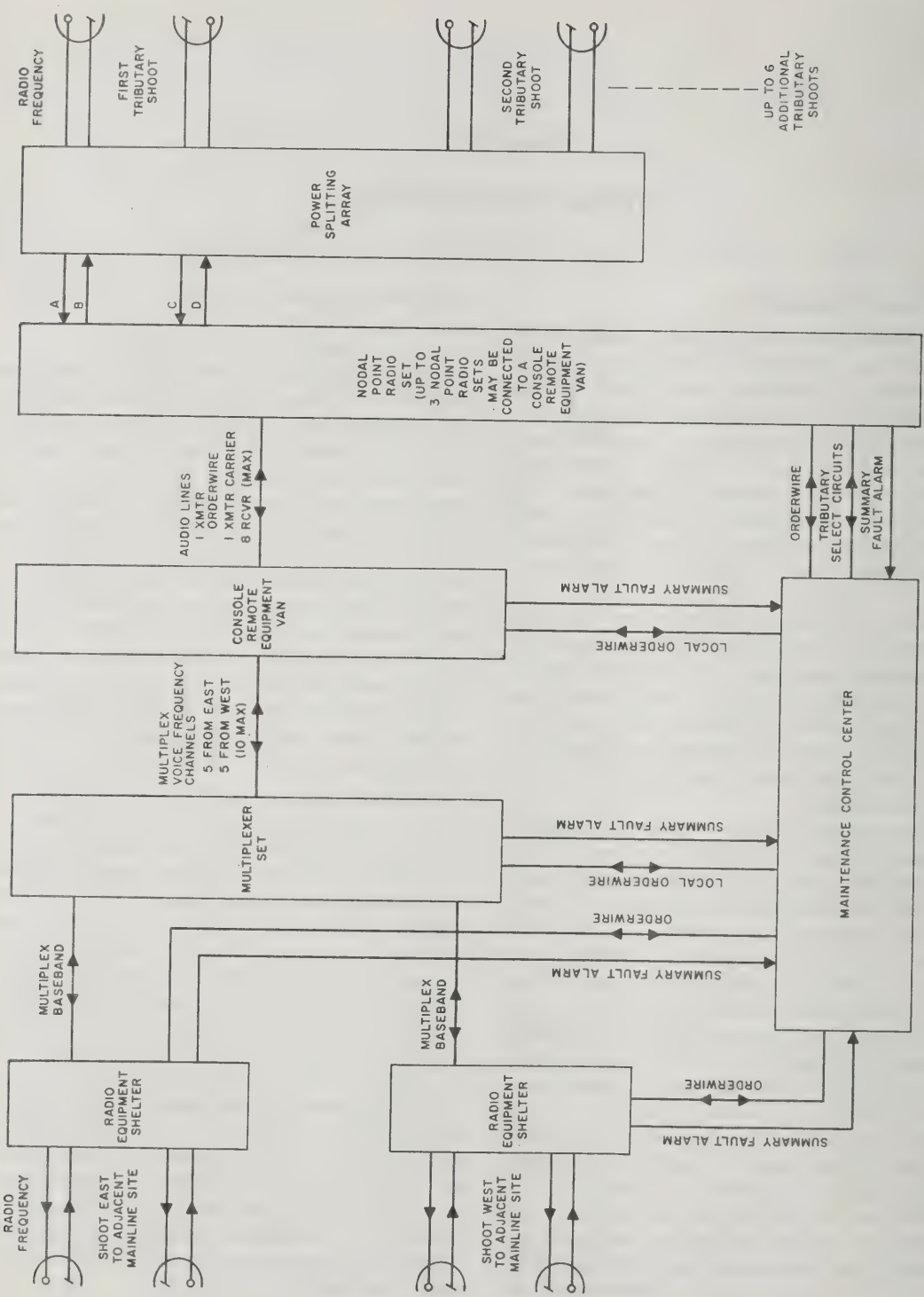


Figure 4-1. Nodal point radio set, system application.

f. Summary fault alarm circuits are sent from all shelters and vans to the maintenance control center, to permit monitoring of the equipment in the shelters and vans at the maintenance control center without requiring personnel to be at the shelters and vans continuously.

g. Nodal Site 9.1 (Donnersberg) does not have a console remote equipment, but uses the console remote equipment emplaced at Site 50.1 (Hoenstadt). Figure 4–2 shows how the console remote equipment at Site 50.1 is used by the nodal point radio set at Site 9.1. Local orderwire and summary alarm signal flow to the maintenance control center is the same as in a nodal site equipped with a console remote equipment and is not shown in figure 4–2. The console remote equipment at Site 50.1 receives the five dedicated channels from the mainline system and processes them for transmission to the tributaries serviced by Site 50.1, via the sector one equipment of the console remote equipment and its associated nodal point radio set. The three tributaries serviced by Site 9.1 are handled by the sector two equipment of the console remote equipment and its associated nodal point radio set at Site 9.1. These transmit and receive paths between Sites 50.1 and 9.1 are carried by three additional multiplex channels. At Site 50.1, the sector two (Site 9.1 intelligence) of the console remote equipment is sent to the multiplexer set over groups of four lines per tributary. Only two channels are used in the direction from Site 50.1 to Site 9.1, one for the orderwire channel and one for the carrier channel. The remaining channels are not used in this direction but are used in the reverse direction, one for each tributary of Site 9.1. This intelligence is transmitted via the mainline radio link to Site 9.1 and the multiplexer set of that site. The three channels are then sent to the nodal point radio set van for processing and transmission to the Site 9.1 tributaries. The console remote equipment feeds the two (one carrier channel and one orderwire channel) audio line transmit channels to the multiplexer set, which inserts them into the multiplex baseband fed to the radio equipment shelter. The frequency-modulated output of the radio equipment shelter, after transmission from the Site 50.1 antennas to the Site 9.1 antennas, is applied to the Site 9.1 radio equipment shelter. The resultant multiplex baseband is fed to the multiplexer set. Since the multiplexer output (two transmit carriers) now represents a console remote equipment output, it is fed to the nodal point radio set to frequency-modulate a carrier for transmission to the tributaries.

h. In the receive direction (tributary to mainline), the console remote equipment at Site 50.1 is used in a similar way. The nodal point radio set at Site 9.1 receives the frequency-modulated carrier from the transmitting tributary and feeds an audio receive signal to the multiplexer set over one of the three audio lines. Before the tributary data can be applied to the mainline, it is converted to usable form by the console remote equipment located at Site 50.1. The data reaches the console local equipment in a way similar to that described for the transmit direction, using the radio equipment shelter and antennas at Site 9.1 and the antennas, radio equipment shelter, and multiplexer set at Site 50.1. The console remote equipment receives its input from the three audio line receive channels (sector 2) and feeds its output to the mainline over one of the five dedicated console system multiplex channels.

i. From the foregoing, it can be seen that eight channels are needed in the frequency-modulated carrier between the Site 9.1 and Site 50.1 antennas so that Site 9.1 can use the Site 50.1 console remote equipment. The normal five console system channels are used, as well as an additional three channels, since Site 9.1 currently services three tributaries to carry the data normally exchanged directly between the console remote equipment and the nodal point radio set.

j. Orderwire to other mainline sites is processed as described in paragraph 4–1*e* and shown in figure 4–2.

4–2. Nodal Point Radio Set Block Diagram Description

a. 1–Kw Configuration. The basic signal paths for the 1–kw configuration are shown

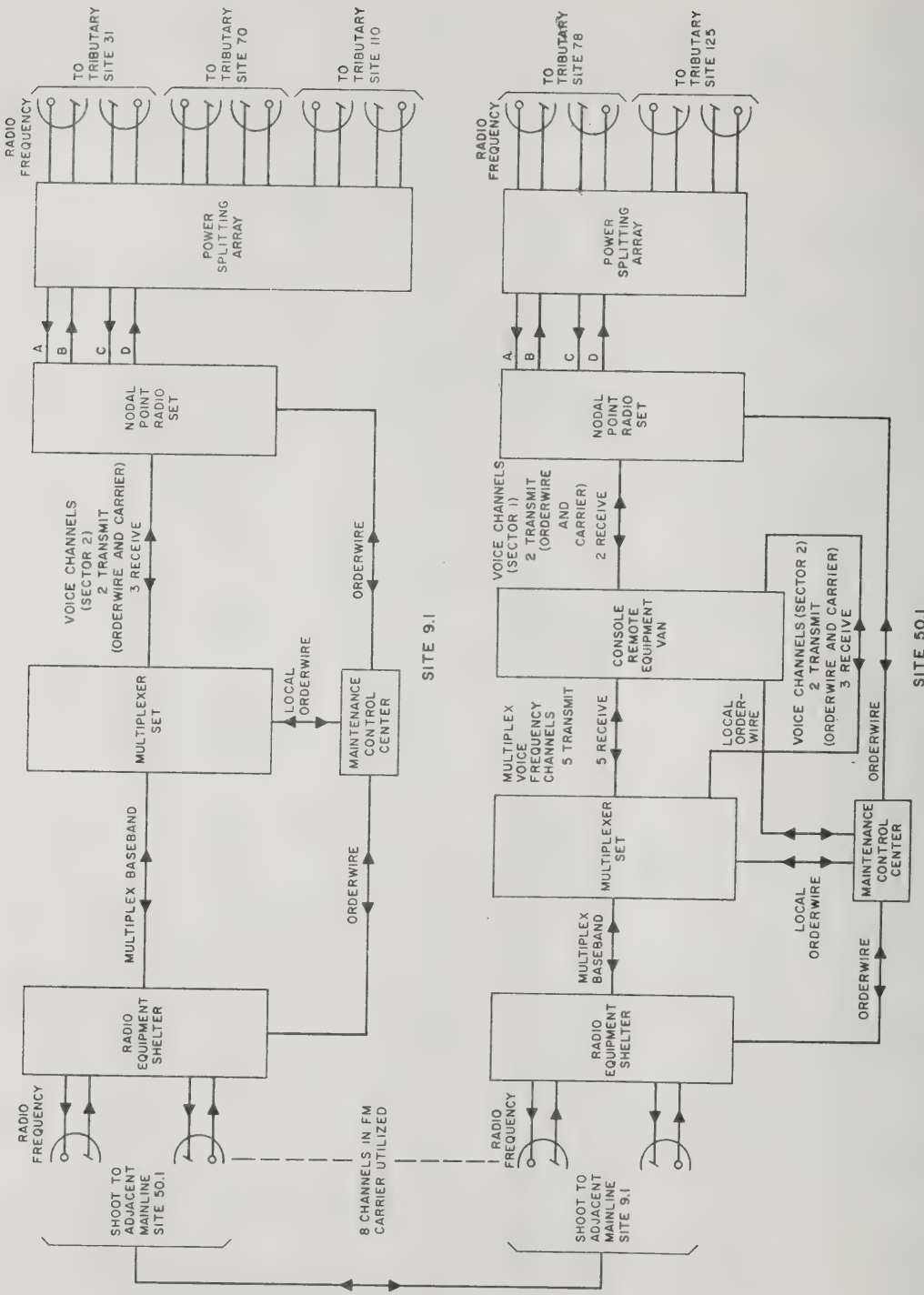


Figure 4-2. Use of Site 50.1 console remote equipment in Site 9.1

in figure 6–3 and are described in (1) through (4) below.

(1) *Received signal path.*

(*a*) The 4.4– to 5.0–gHz frequency modulation (fm) carrier signals received from the tributaries are fed to the two dual receivers via the power-splitting array. The signals received from the vertically polarized feedhorns of antennas A and B are applied to the A and B inputs, respectively, of the dual rf multicoupler cabinet of receiver A. The signals received from the horizontally polarized feedhorns of the same antennas are applied to the A and B inputs, respectively, of the dual rf multicoupler cabinet of receiver B. Duplexers A and B permit the receiving and transmitting equipment to share common feedhorns.

(*b*) The fm carrier signals applied to each dual rf multicoupler consist of from two to eight fm carriers spaced 400 kHz apart. These signals are converted to intermediate frequencies (a different one for each carrier) and fed to from two to eight dual IF and baseband cabinets. Each of these cabinets processes one carrier that has been down-converted to an intermediate frequency. Figure 6–3 shows the dual IF and baseband cabinet for tributary 1 and the four tributary 1 IF signals applied to it. The two tributary 1 IF signals from dual rf multicoupler cabinet A are applied to drawer A, while the two tributary 1 IF signals from dual rf multicoupler cabinet B are applied to drawer B. Similarly, the four IF signals for each of the tributaries 2 through 8 are applied to drawers A and B in each of up to seven other dual IF and baseband cabinets.

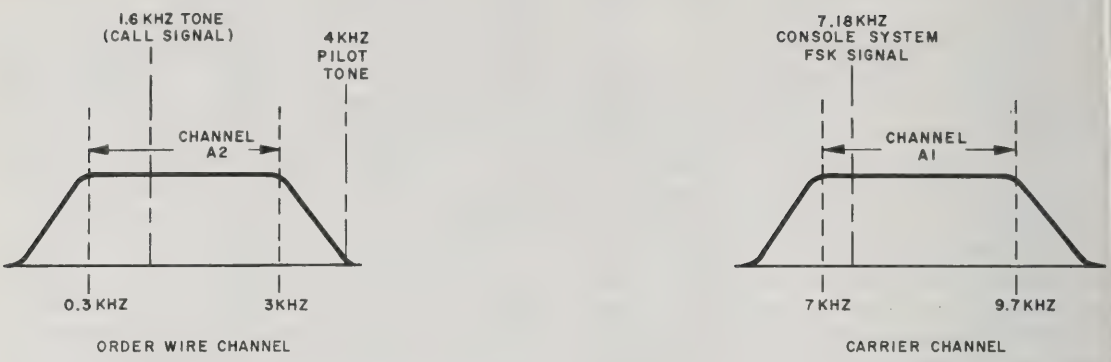
(*c*) The four tributary IF signals in the dual IF and baseband cabinet for tributary 1 are each converted to a 9.8–MHz second IF. Following the conversion, the two 9.8–MHz signals in drawer A are amplified and combined with the two 9.8–MHz signals from drawer B in a diversity combining circuit. The resulting combined tributary IF signal is demodulated to provide a baseband signal, amplified, and then applied to the central equipment cabinets. The same processing is performed on the two 9.8–MHz second IF signals in drawer B. Similarly, the four tributary IF signals for each of tributaries 2 through 8, are processed in their respective dual IF and baseband cabinets and applied to the central equipment cabinets. Thus, two redundant baseband outputs are applied to the central equipment cabinets for each tributary.

(*d*) In the central equipment cabinets, the baseband outputs for each tributary are applied to a switching unit (two to eight switching units) which can be either manually or automatically set to select either baseband output for processing. When set for automatic operation, each switching unit operates under the control of two sets od 4–kHz tone and noise receivers. Each set of 4–kHz tone and noise receivers continuously monitors a baseband output for the presence of a 4–kHz pilot tone and excessive noise. In the absence of the pilot tone or the presence of excessive noise, the switching unit automatically switches to the second baseband output. If the pilot tone returns or the excessive noise disappears, the switching unit, when in the automatic mode, will reset itself to the prime baseband output.

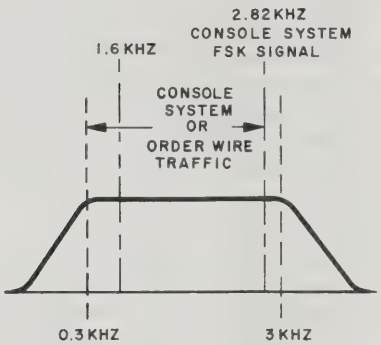
(*e*) The baseband output selected by the switching unit contains console system or orderwire traffic (B, fig. 4–3). The console system traffic consists of individual tributary signals and the 2.82–kHz console system frequency shift keying (fsk) signal. These signals, one from each tributary, are routed to the console remote equipment for subsequent application to the mainline. Orderwire traffic consists of call signals (1.6–kHz tone), orderwire speech, and pilot tone. The orderwire call signals are routed to the maintenance control center, which returns a remote select control signal to the central equipment cabinet B to select the desired orderwire channel. The orderwire speech is routed to the handsets at the maintenance control center or the central equipment cabinets. The 4–kHz pilot tone is routed to the 4–kHz receiver, where it is used for the detection of equipment malfunction.

(2) *Transmitted signal path.*

(*a*) The console system voice and digital data signals (fig. 6–3) received from the mainline via the console remote equipment are applied to the central equipment cabinets of the nodal point radio set. The console remote



A. NODAL POINT SITE-TO-TRIBUTARY SITE 2-CHANNEL BASEBAND SIGNAL



B. TRIBUTARY SITE-TO-NODAL POINT SITE BASEBAND SIGNAL

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Figure 4–3. Nodal point site-tributary site baseband signals.

equipment inputs are combined with order-wire inputs from the nodal point radio set telephone handset or the maintenance control center and with the 4–kHz pilot tone generated in the central equipment. The resulting composite two-channel baseband signal, show in A, figure 4–3, is applied to transmitters A and B.

(*b*) In transmitters A and B, the composite baseband signal is applied to the modulator exciter drawer where it frequency-modulates a 70–MHz subcarrier. The resulting 70–MHz fm subcarrier is sampled for the presence of pilot tone, providing a 4–kHz pilot tone signal which is applied to a 4–kHz tone receiver in the central equipment to inhibit the transmitter modulation failure alarm circuits. The absence of this 4–kHz pilot tone signal produces a modulation failure alarm signal which is applied to the rf switchover and power divider drawer (in transmitter B). The operation of the rf switchover and power divider drawer is described in (*d*) below.

(*c*) The 70–MHz subcarrier is mixed with a locally generated 2.27– to 2.43–gHz signal in the modulator exciter drawer to produce a 2.2– to 2.5–gHz fm carrier. This carrier is applied to the frequency multiplier drawer for frequency doubling. The resulting 4.4– to 5.0–gHz fm carrier is applied to the RF switch-

over and power divider drawer through a directional coupler (in the frequency multiplier drawer) which provides an RF monitoring signal. The RF monitoring signal is one of the signals controlling the operation of the RF switchover and power divider drawer.

(*d*) The RF switchover and power divider drawer is manually set to select the 4.4– to 5.0–gHz output of either transmitter for application to power amplifiers A and B. If the output of the selected transmitter fails, the resulting absence of the rf monitoring signal causes the RF switchover and power divider drawer to switch to the second transmitter. The RF switchover and power divider drawer also switches to the second transmitter upon receipt of a modulation failure alarm signal. When the output of the prime selected transmitter return to normal levels, the RF switchover will reset itself regardless of the cause of failure. The generation of the modulation failure alarm signal is described in (*b*) above.

(*e*) The 4.4– to 5.0–gHz fm carrier selected by the RF switchover and power divider drawer is applied to power amplifiers A and B. The 1–kw outputs of power amplifiers A and B are applied, via the power-splitting array, to the vertically polarized feedhorns of the A antennas and the horizontally polarized feedhorns of the B antennas, respectively. Duplexers A and B, connected between the power amplifiers and the power-splitting array, permit the power amplifiers and dual receivers A and B to share common feedhorns. Each duplexer also monitors the power reflected by the associated antenna feedhorns and waveguide runs. When the reflected power is excessive, the duplexer generates an antenna mismatch alarm signal that shuts down the associated power amplifier.

(3) *Radio equipment alarm signal paths.* Each of the transmitters and power amplifiers generates an alarm signal when it malfunctions. In the receiver, alarm signals are generated in each multicoupler cabinet and each dual IF and baseband cabinet. The receiver, transmitter, and power amplifier alarm signals are applied to central equipment cabinet B where they light the appropriate switch-indicators on the central alarm panel and actuate the alarm bell in the central alarm equipment module. The radio equipment alarm signals are summarized with the utility alarm signals ((4) below), producing a summary alarm signal. This signal is applied to the maintenance control center where it lights an indicator and actuates an alarm bell.

(4) *Utility equipment alarm signal paths.* The waveguide pressurizer dehydrator and antenna deicers also generate alarm signals when they malfunction. As with the radio equipment alarm signals ((3) above), the utility equipment alarm signals are applied to central equipment cabinet B where they light appropriate switch-indicators and actuate the alarm bell. These signals are also summarized with all other alarm signals in the central equipment to produce the summary alarm signal which is applied to the maintenance control center.

(*a*) The waveguide pressurizer dehydrator alarm signal is generated by the waveguide pressurizer dehydrator whenever the air pressure in the antenna waveguide runs cannot be maintained at 1.0 $\pm$0.5 psig.

(*b*) A deicer alarm signal is produced by the deicer control and monitor module whenever an antenna deicer heater (up to 16 heaters) burns out or its associated circuit is defective. The deicer control and monitor module contains current sensing relays in the deicer heater circuits. The relays drop out when the associated heaters burn out or the circuits are defective, generating the deicer summary alarm signal.

b. 1–Watt Configuration. The 1–watt nodal point radio set configuration is used when the number of tributaries served and/or the distances between the nodal point site and tributary site antennas require no more than 1 watt of power. Only one 1–watt nodal point radio set is used, and its specific application is given in paragraph 1–8. Signal paths for the 1–watt configuration are shown in figure 6–4 and described in (1) through (4) below.

(1) *Received signal path.* The basic flow of the received signal is identical to that described for the 1–kw nodal point radio set (*a*(1) above).

(2) *Transmitted signal path.* Up to the output of the central equipment, the basic flow of the transmitted signal is identical to that described for the 1–kw nodal point radio set (*a*(2) (*a*) above). The basic flow from the output of the central equipment is described in (*a*) through (*d*) below.

(*a*) In transmitters A and B, the composite baseband signal is applied to the modulator exciter drawer, where it frequency-modulates a 70–MHz subcarrier. The resulting 70–MHz fm subcarrier is sampled for the presence of pilot tone to provide a 4–kHz pilot tone signal from each transmitter. The 4–kHz pilot tone is applied to a 4–kHz tone receiver in the central equipment to inhibit the transmitter modulation failure alarm circuits. The absence of a 4–kHz pilot tone signal produces a modulation failure alarm signal, which is applied to the modulator switchover and power divider drawer (in transmitter B). The operation of the modulator switchover and power divider drawer is described in (*b*) below.

(*b*) The modulator switchover and power divider drawer is manually set to select the 70–MHz subcarrier output of either 70–MHz modulator for application to two 70–MHz amplifiers, one in each transmitter. If the output of the selected 70–MHz modulator fails, the resulting absence of the 4–kHz monitoring signal causes the modulator switchover and power divider drawer to switch to the second modulator. If the output of the prime selected 70–MHz modulator returns, the modulator switchover will reset itself to the prime selected 70–MHz modulator. The selected 70–MHz subcarrier is split by the power divider and fed back to both transmitters for additional processing.

(*c*) In each transmitter, the 70–MHz subcarrier is mixed with a locally generated 2.27– to 2.43–gHz signal in the modulator exciter drawer to produce a 2.2– to 2.5–gHz fm carrier. This carrier is applied to the frequency multiplier drawer for frequency doubling. The resulting output of the frequency multiplier drawer and, therefore, of the transmitter is a 4–4– to 5.0–gHz fm carrier.

(*d*) The 1–watt, 4.4– to 5.0–gHz outputs of transmitters A and B are fed, via the power-splitting array, to the vertically polarized feedhorns of the A-antennas and the horizontally polarized feedhorns of the B antennas, respectively. Duplexers A and B connected between the transmitters and the power-splitting array, permit the transmitters and dual receivers A and B to share common feedhorns. Each duplexer also monitors the power reflected by the associated antenna feedhorns and waveguide runs. When the reflected power is excessive, the associated duplexer generates an antenna mismatch signal that actuates the alarm circuit in the vswr monitor.

(3) *Radio equipment alarm signal paths.* The basic flow of the radio equipment alarm signals is similar to that described for the 1–kw nodal point radio set van (*a*(3) above). The only difference is the substitution of vswr alarm signals instead of power amplifier alarm signals.

(4) *Utility equipment alarm signal paths.* The basic flow of the utility equipment alarm signals is similar to that described for the 1–kw nodal point radio set (*a*(4) above).

4–3. Deicer Monitor Theory of Operation

The deicer monitor (fig. 6–5) provides control and alarm indicating facilities for up to 16 deicers. The assembly operates on 115–volt ac power.

a. Switches S1 through S8 are used to energize the deicers and to enable, but not energize, the alarm indicator lamp circuit associated with each deicer. Each switch controls two deicers. In addition, switch S1 controls the application of ac power to the alarm indicating circuit. Except for this difference, all eight switching and alarm indicator circuits are identical and the discussion that follows refers only to the control and alarm circuit consisting of switch S1, relays K2 and K3, and indicator units DS1, DS9, and DS10.

b. When switch S1 is closed, 115–volt ac is applied through the coil of relay K2 to energize deicer 1A and through the coil of relay K3 to energize deicer 2A. In addition, 115–volt ac is applied to the primary of stepdown

transformer T1. Indicator lamp DS1 connects to the 115–volts ac through current limiting resistor R1 and lights to indicate that switch S1 is closed. When a deicer is operating normally, the current flow through the relay connected in series with it is sufficient to keep the relay energized. If the deicer develops an open circuit, no energizing current flows through the associated relay and contacts 4 and 5 of the relay close to complete the circuit path of the alarm indicating circuit. For example, assume that deicer 1A opens, causing relay K2 to deenergize. When this occurs, contacts 4 and 5 of relay K2 and contacts 1 and 2 of switch S1 complete the path that includes alarm indicating lamps DS9 and DS10 in indicator unit XDS9, winding 5–6 of transformer T2, and winding 3–4 of transformer T1. The current flow through winding 5–6 of transformer T2 induces a current in winding 1–3, which in turn energizes relay K1. The remote alarm circuit is completed through closed contacts 5 and 7 of energized relay K1. Failure of any deicer energizes the remote alarm circuit while those alarm indicating lamps corresponding to the defective deicer are lighted.

4–4. Vswr Monitor Theory of Operation

The vswr monitor, used in 1–watt nodal point radio sets only, continuously monitors the power reflected by the antennas, the phase-splitting array, and the associated waveguide components. It provides alarm signal whenever the reflected power is excessive. The vswr monitor (fig. 4–4) contains two relays, K1 and K2, and a reset pushbutton, S1.

a. During normal operation, K1 is energized and K2 is deenergized. Relay K1 is energized by momentarily pressing S1. Relay K1 remains energized through the self-latching path provided by contacts K1–1 and K1–2. The power required to energize K1 is provided by diode CR2, which rectifies the ac voltage applied between contacts J3–A and J3–B.

b. When the associated nodal point radio set duplexer detects a high voltage standing wave ratio due to excessive reflected power, the voltage applied to connector J1 energizes K2, which closes normally-open contacts K2–1 and K2–7. The closure of K2–1 and K2–7 shorts the coil of K1. This action deenergizes K1, to close normally-open contacts K1–6 and K1–8 and provide the vswr alarm signal. When the excessive reflected power is no longer detected, switch S1 is pressed to restore the module to normal operation.

4–5. Power-Splitting Arrays Theory of Operation

Figures 4–5 and 4–10 show the array of power-splitting devices used at each nodal point site. The arrays enable a single nodal point radio set van to service up to eight tributaries. A power-splitting array network consists of 20–db and 3–db directional couplers cascaded to direct the required amount of power to each feedhorn. A description of the operation of the power-splitting arrays at Site 8.1 (fig. 4–6) is given in *a* and *b* below. The operation of the arrays at the other nodal point sites are similar.

a. Site 8.1 services two groups (sectors) of tributaries with two nodal point radio sets. Nodal point radio set A provides a transmitter output of 1,000 watts at ports B and D, which is divided into appropriate transmission powers for Sites 97, 90, 30, 54, 39, and 106. Each 3–db coupler splits transmitted power by one-half, while each 20–db coupler divides transmitted power in a ratio of approximately 100:1. For an example of tracing the waveguide run for a sample shoot at Site 39, 1,000 watts at ports B and D is split four times to 500, 250, 125, and finally 62.5 watts, which is the transmission power level to Site 39. In another example, the shoots to Sites 97 and 90, 1,000 watts is split by the first 3–db coupler to 500 watts and then divided by the 20–db coupler so that 5 watts are fed to the feedhorn for the shoot to Site 97 and 495 watts are fed to the feedhorn for the shoot to Site 90. The feedhorn powers for all feedhorns fed by nodal point radio sets A and B are shown in figure 4–6.

b. The couplers also combine the individual received signals from the tributary sites. Since the power-splitting network is a reciprocal device, received power is also divided in the receiving mode. The reciprocity of the power-splitting device poses a problem

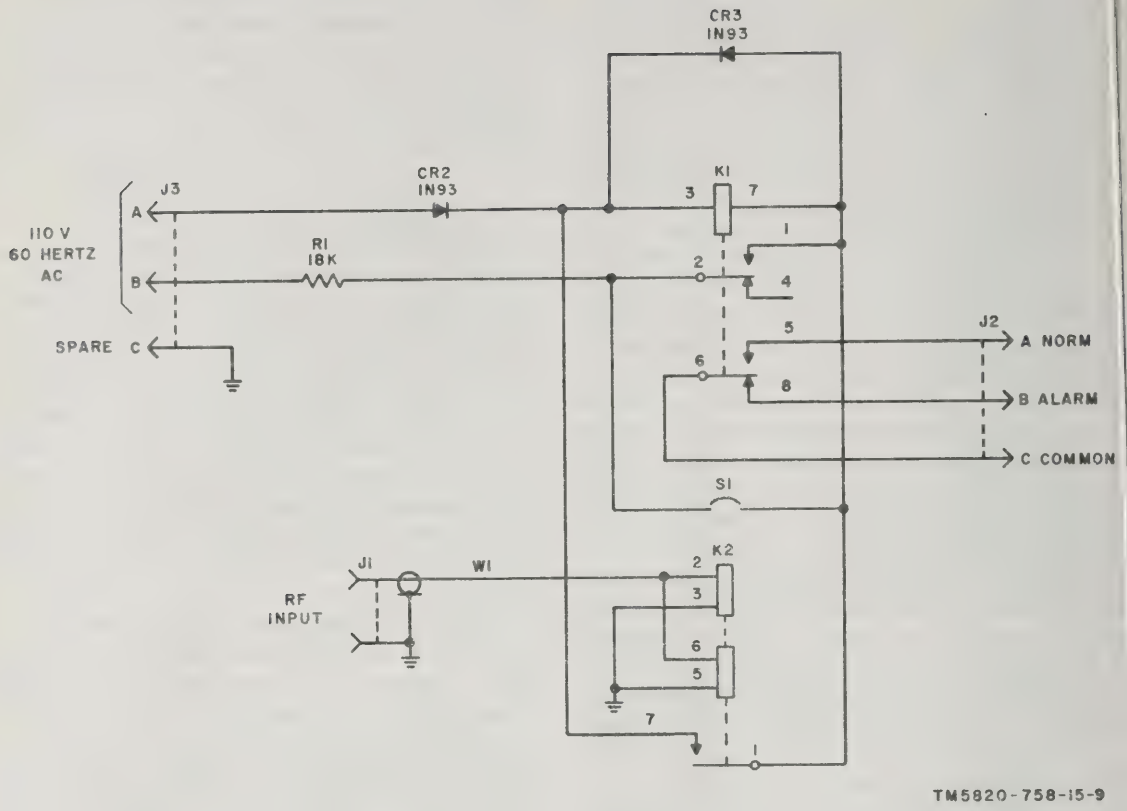

Figure 4-4. Vswr monitor, schematic diagram.

when using 20-db couplers. The design margins are sufficient to encompass the loss in the 3-db couplers, but are insufficient for the 20-db couplers. A duplexing network is, therefore, used to shunt the received signal in the decoupler arm over to the main arm without affecting the transmitter power division. This arrangement bypasses the 20-db couplers and introduces only a 3-db loss in the receiving mode. This configuration is necessary only in the power dividers carrying transmitter energy. In the lines handling received energy alone, the combination of the 20-db couplers and the duplexer is replaced by a 3-db coupler.

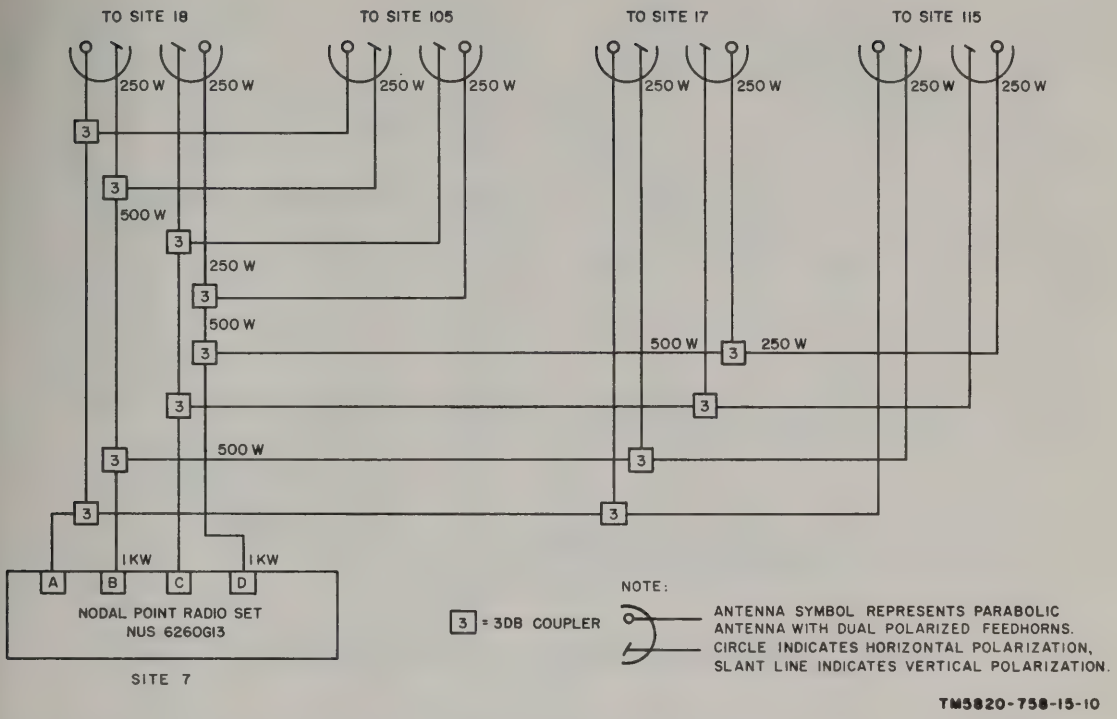

Figure 4–5. Power-splitting array, Site 7 waveguide configuration.

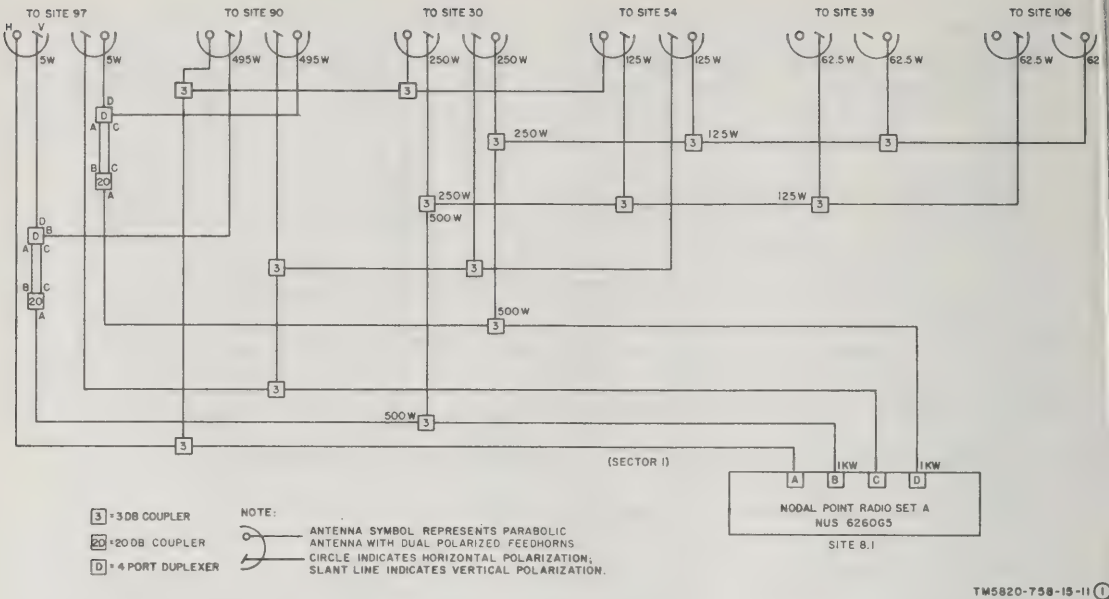

Figure 4-6(1). Power-splitting array, Site 8.1, waveguide configuration (sheet 1 of 2).

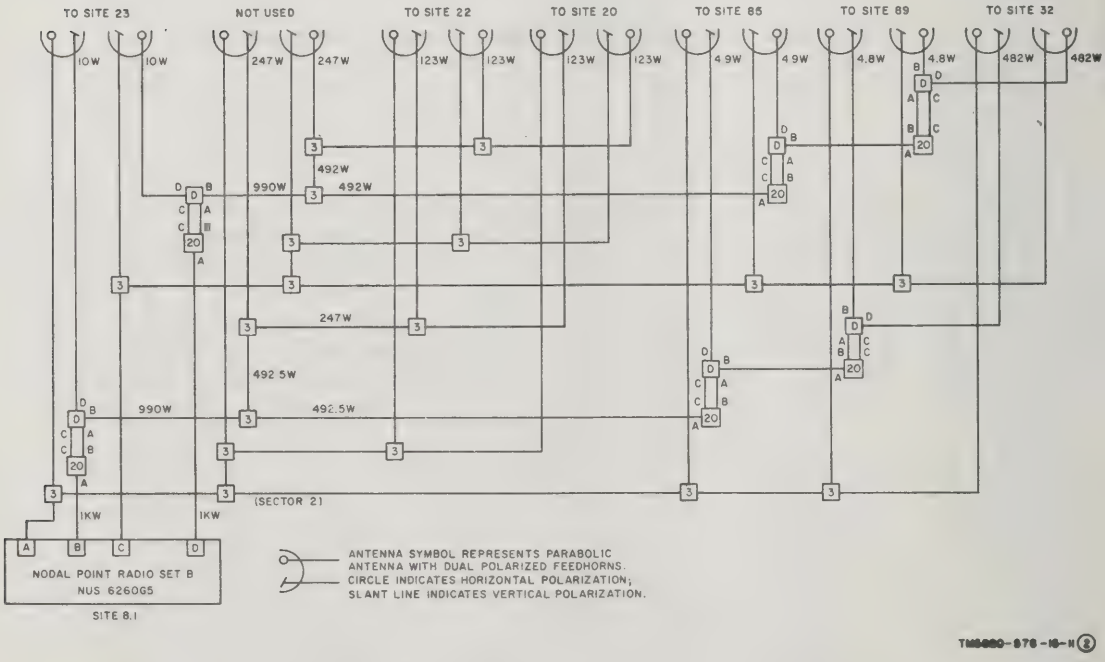

Figure 4-6(2). Power-splitting array, Site 8.1, waveguide configuration (sheet 2 of 2).

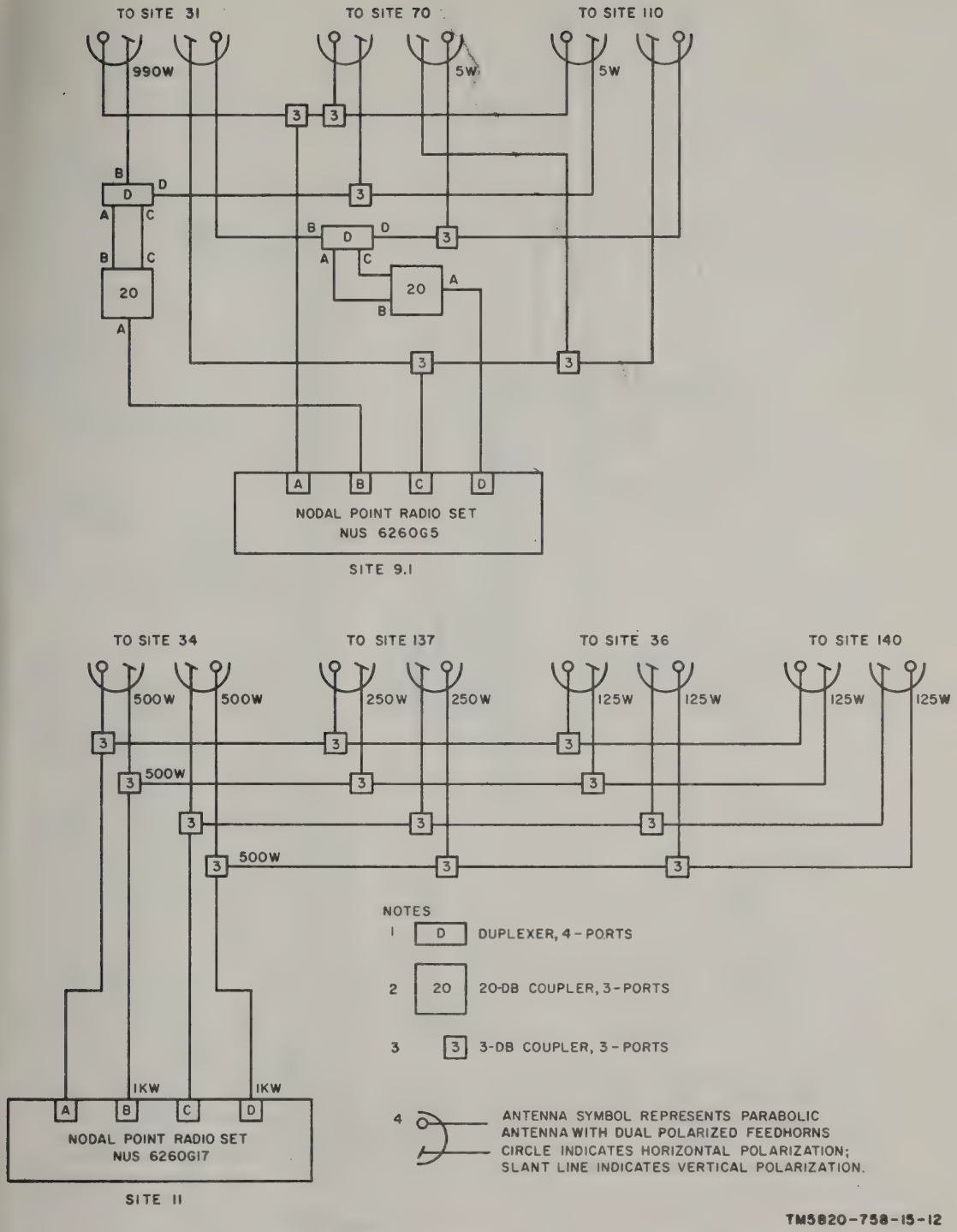

Figure 4-7. Power-splitting arrays, Site 9.1 and Site 11, waveguide configuration.

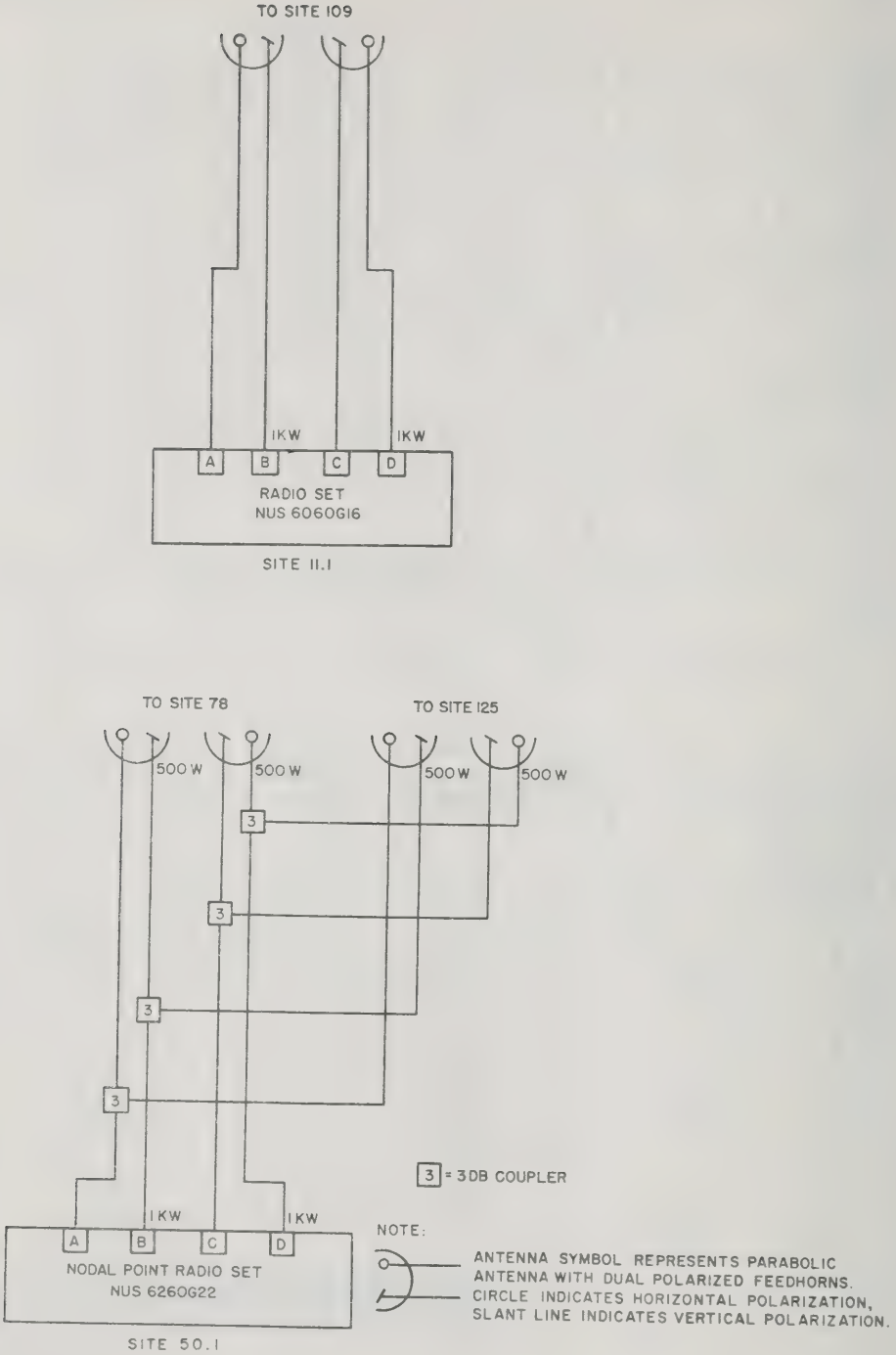

Figure 4–8. Power-splitting arrays, Site 11.1 and Site 50.1, waveguide configuration.

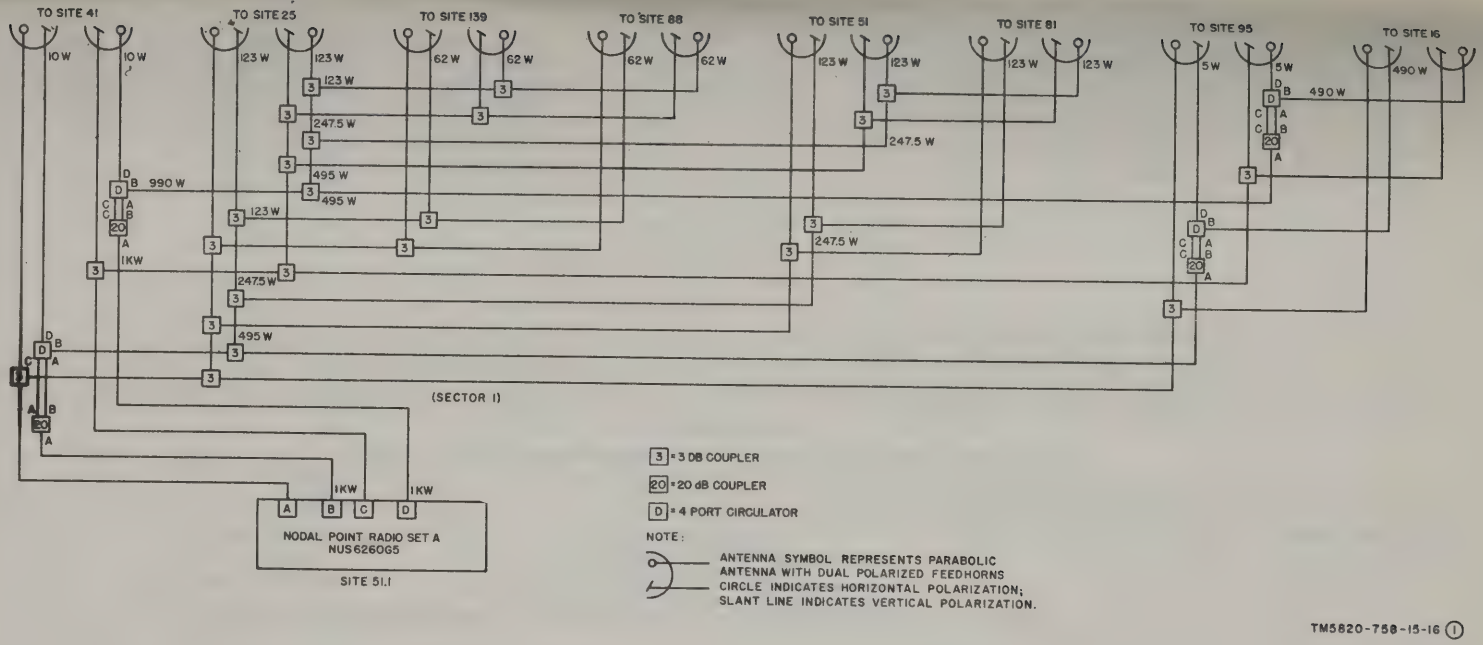

Figure 4-9(1). Power-splitting array, Site 51.1 waveguide configuration (sheet 1 of 2).

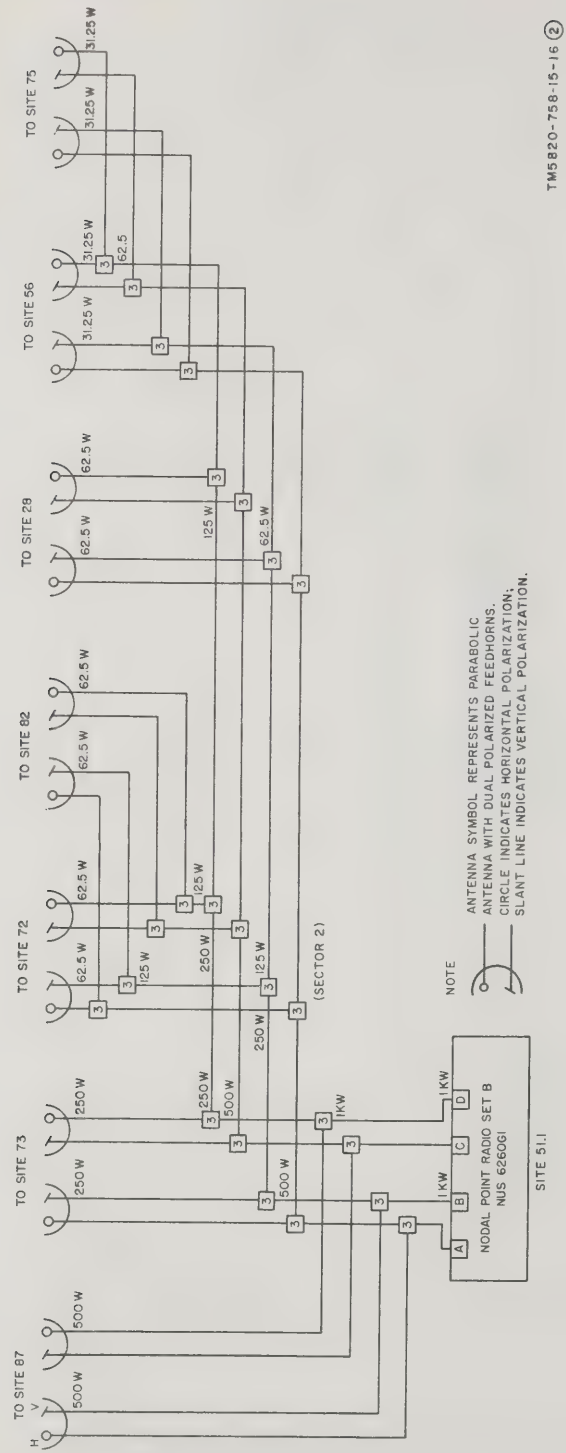

Figure 4-9(2). Power-splitting array, Site 51.1, waveguide configuration (sheet 2 of 2).

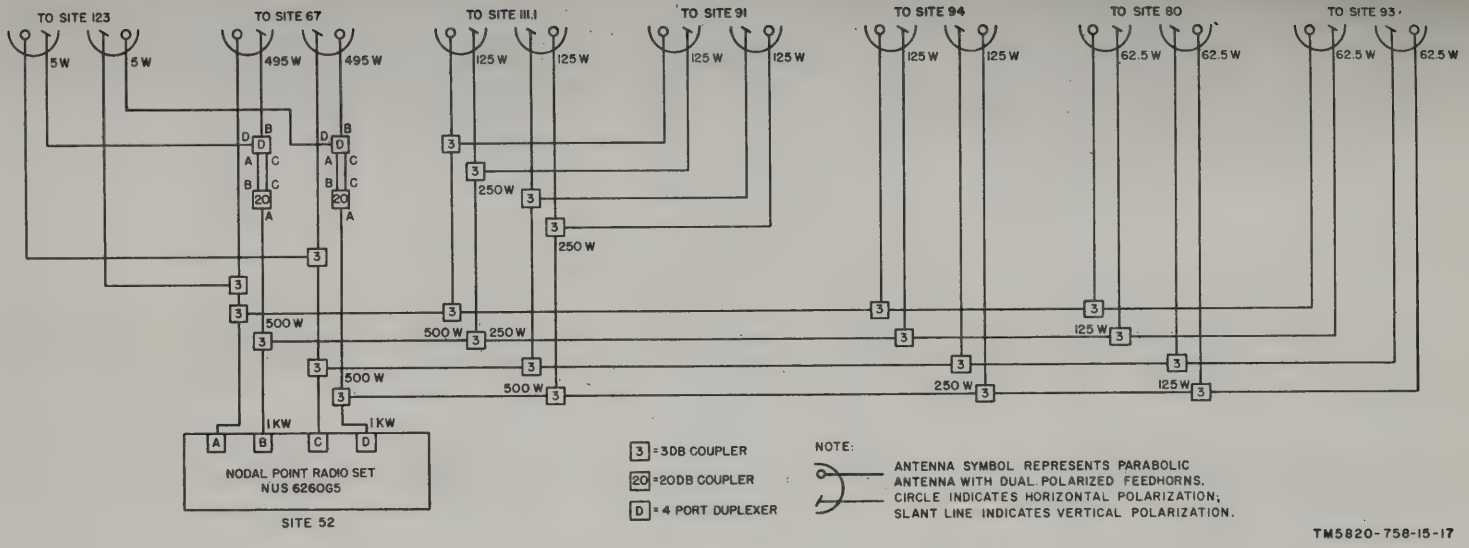

Figure 4–10. Power-splitting array, Site 52, waveguide configuration.

CHAPTER 5

MAINTENANCE

Section I. PREVENTIVE MAINTENANCE

5-1. General

Preventive maintenance consists of a series of checks and adjustments performed at regular intervals to insure that the nodal point radio set will be operational at all times.

Preventive Maintenance Routines

Interval	Routine
Daily	Metering checks
When possible	Cleaning
Monthly	Air filter maintenance
Quarterly	Alignment and inspection

5-2. Metering Checks

Perform the metering checks required by the preventive maintenance section of the instruction manual for each cabinet in the nodal point radio set van. Record results in the station log.

5-3. Cleaning

The equipment should be cleaned whenever it is possible without impairing its traffic carrying ability. When alignment is performed, partial shutdown of the equipment will allow cleaning. The air conditioners and the dehydrator can be shut off for short periods of time without penalty.

5-4. Air Filter Maintenance

Warning: **Prolonged breathing of cleaning compound is dangerous; make certain that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on your hands.**

Air filter maintenance is the most important nonelectric routine that is required to assure continuous operation of the equipment. The lack of proper care (cleaning and replacement) of air filters can cause equipment breakdown due to excessive heating or jamming of rotary controls as a result of dust accumulation. Replace all filters once monthly and the air conditioner filters more often if needed. Clean dirty filters with strong soap, detergent, or cleaning compound (FSN 7930-395-9542); dip in SAE 30 oil; drain for 24 hours before re-use.

5-5. Alignment

Overall alignment of the equipment in the van is performed at initial installation. After replacement of faulty modules and on a routine basis (recommended quarterly), perform alignment procedures given in the applicable instruction manual.

5-6. Inspection

Inspection is performed on a routine basis and normally should coincide with alignment as the equipment is partially shut down during alignment. Check mainly for frayed or worn cables and loose cable connections, as well as for motor shafts that need cleaning or lubrication.

Section II. TROUBLESHOOTING

5-7. General Troubleshooting Information

Nodal point radio set malfunctions are generally caused by a primary power failure, a failure in the signal from an associated distant site, or an equipment failure within the van itself. The general troubleshooting information given in *a* through *e* below and the

troubleshooting procedures given in paragraph 5–9 will assist maintenance personnel in isolating the trouble.

a. Alarm Indications. The nodal point radio set incorporates an automatic self-check alarm system which continuously monitors the operational status of the equipment within the van, the antenna deicer equipment, and the signals from associated distant sites. Summary alarm conditions are displayed at the maintenance control center. Maintenance personnel are thereby directed to the nodal point radio set van. Inside the van, alarm conditions are displayed on the central alarm panels in central equipment cabinet B. The central alarm panels contain switch-indicators designated R.F. MCPLR A, R.F. MCPLR B, I.F. and B.B. 1 through I.F. and B.B. 8 (depending on number of tributaries serviced), XMTR A, XMTR B, POWER AMPL A and POWER AMPL B (if used), VSWR MON A and VSWR MON B (if used), SUMMARY DEICER, DEHYDRATOR, POWER SUP 1–4, POWER SUP 5–8, P.S. CARR CHAN, and SPARE. With the exception of those designated SPARE, all switch-indicators monitor the operation of their respective equipments and light red when an equipment malfunction occurs. For example, if the XMTR A switch-indicator lights red, a malfunction has occurred in transmitter A or its associated circuits. This could also indicate a defect in the cabling carrying the alarm information or the alarm circuit. In any case, an alarm condition is indicated by a red light on the applicable switch-indicator and the sounding of a bell after a 5–second delay. The 5–second delay inhibits unwarranted alarm conditions caused by transient electrical disturbances and signal path interruptions.

b. Visual Inspection. A careful visual inspection of the van may reveal abnormal conditions of the van equipment. Interconnecting cables should be inspected for loose connectors or broken connections. Cabinet drawers should remain closed, except for maintenance periods, to insure proper operating temperatures and to prevent dirt from accumulating within the cabinets. Air filters should be inspected, cleaned, and lubricated regularly to provide dust-free ventilation for operating equipment.

c. Meter Indications. The power amplifie transmitters, and receivers are equipped wi built-in meters on the front panels and insi the drawers. These meters and their associat selector switches permit stage-by-stage mo toring.

d. Voltage Measurements. Power supp voltages are monitored by setting the fro panel meter selector to the appropriate pos tions and observing the meter indication Primary power applied to the transmitters a receivers can be monitored by connecting Mu timeter TS–352B/U (multimeter) to the fro panel convenience outlets.

e. Intermittent Troubles. Malfunctions o an intermittent nature may be traced to loos connections, noisy tubes, defective parts, an loose mechanical assemblies. Connectors an wiring should be thoroughly checked for poo ly soldered joints, frayed shield wires, an damaged plugs or sockets. Lightly tapping o jarring tubes and associated circuits may re veal the source of an intermittent condition

f. Operational Tests. Reference to the trou bleshooting tables in the equipment manual for both normal and abnormal indications wi provide valuable troubleshooting assistance The primary power to the van should be mai tained within the operating voltages and loa conditions specified in the primary power re quirements.

5–8. Test Equipment Required

The test equipment required for troubleshoo ing is given in the technical manual for th equipment determined by the following proce dures to be defective. The only additional tes equipment required is Multimeter TS–352B/U used in the deicer, dehydrator, and van cablin testing.

5–9. Troubleshooting Procedures

a. Alarm Acknowledgement. When a equipment malfunction occurs, the applicabl indicator-switch in central equipment cabine B lights red and a bell sounds after a 5–secon delay. The alarm is acknowledged by pressin the lighted indicator-switch. This action si lences the alarm bell and causes the indicato switch to light yellow. The yellow color indi

cates that the malfunction has been acknowledged. When the malfunction has been corrected, the indicator-switch lights green and the bell sounds after a 5-second delay. At this point, the bell is silenced by pressing the indicator-switch again. This action turns off the green indication and restores the alarm circuit to the original OFF state.

b. Procedures. The troubleshooting procedures given in (1) through (6) below are for the most part based on the interpretation of alarm indications within the modal point radio set van; however, not all malfunctions result in alarm indications. When a fault occurs that does not cause an alarm indication, suspect wire or cable breaks in the cabling between the central equipment in the nodal point radio set van and the console remote equipment or the maintenance control center. Perform continuity checks to determine the location of the open circuit. Repair the break, and remove the cause.

(1) *Central equipment.* The central equipment consists of two cabinets designated A and B. Cabinet A contains two patch panels and two 4-nest frame and module assemblies. Each nest processes the signals received from one tributary site. Most modules in the frame and module assemblies contain alarm and signaling indicators that display the status of communications traffic through the nodal point radio set van. Cabinet B includes two central alarm panels that provide a comprehensive display of the status of all major equipments in the van. Troubleshooting starts at this panel. Then, by direction of the central alarm panel indicators, maintenance personnel go to the equipment specified by the alarm and gain additional insight to the trouble via alarm indications on the malfunctioning equipment. Troubleshooting the central equipment follows the same general procedure. Summary alarms for the central equipment cabinet are for power supplies 1 through 4, 5 through 8, and the carrier channel power supply. Circuit failures are signaled by alarm indicators situated throughout both cabinets. Listed below are alarm indications and typical trouble symptoms encountered in the central equipment. The lists directs maintenance personnel to procedural steps of the troubleshooting procedure chart in POMM 11-5820-575-15.

Symptom	Step designation
Any of I.F and B.B. 1 thru I.F. and B.B. 8 indicators on central alarm panel lights red.	A1 thru A3
XMTR A or XMTR B indicator on central alarm panel lights red.	B1 thru B4
Carrier channel inoperative.	C1 thru C10
Switching unit fails to switchover during failure of priority channel of associated receive circuit.	D
Switching unit fails to switchover when NOISE ALARM indicator DS2 lights on associated priority channel noise receiver.	E
SWITCHOVER indicator DS1 on a switching unit lights but central alarm panel I.F. and B.B. indicator corresponding to channel that switched over is out.	F
Unable to ring other site. Receiver sidetone normal; depressing signaling pushbutton produces no change.	G1 and G2
Receiver handset inoperative; no sidetone. Speaker amplifier normal.	H
Loss of sidetone and incoming signal on both handset and speaker amplifier.	I
Loss of incoming signals on all channels at central equipment cabinet. Sidetone normal; select panel call indications are normal. Traffic is normal at console remote equipment.	J1 thru J4
Loss of incoming signal on one channel. Signal to console remote equipment normal; ring-circuit is operational.	K
Loss of incoming signal on one channel at both central equipment cabinet and console remote equipment. Alarm indications normal.	L
Loss of received signal at maintenance control center.	M1 thru M3
Orderwire send circuit is inoperative; all alarm indications are normal.	N1 thru N4

(2) *Receiving equipment.* Receiving equipment troubles may occur in any one, or combination of, several cabinets, namely, dual RF multicoupler cabinets A and B and from one to eight dual IF and baseband cabinets. Alarm indications are provided on central equipment cabinet B, as well as on the individual receiving equipment cabinets. The alarms on the central alarm panel on central equipment cabinet B specify in which cabinet

trouble exists. Alarms on the individual receiving equipment cabinets are more specific and indicate the particular circuit within a cabinet that is malfunctioning. Usually, alarms on the receiving equipment and central equipment light simultaneously and in various combinations. The chart below shows the typical alarm combinations for the receiving equipment. Combinations are read from top to bottom. The numbers at the bottom of the chart are precedural steps of the receiver troubleshooting chart in POMM 11–5820–574–15. After using the chart below to determine the appropriate step, see receiver troubleshooting chart and follow the procedure given therein. Two causes of loss of received signal are: the transmitter at the other end of the communications link is off the air; atmospheric fading has reduced signal strength. A fade condition can be recognized by constant or intermitte noise receiver NOISE ALARM and switchi unit SWITCHOVER indications on centr equipment cabinet A. Concurrently, the BAS BAND ALARM indicators will light on t IF and baseband cabinet experiencing the fad To further ascertain that a fade conditio exists, set the PHASE LEVEL switches of t phase combiner in the IF and baseband cab net to the LEVEL position. If the BASEBAN ALARM indicator stays on, the alarm cond tion is due to fading. Atmospheric fades ar caused by changing weather conditions such a rain, snow, sleet, and temperature inversion Fading can occur in any combination of r paths to a tributary. The probability of fade occurring in more than one tributary link i uncommon, unless the tributaries are closel spaced either in range or azimuth.

Alarm location and name	Alarm indicator lights																		
CEC MCPLR A	X		X		X														
CEC MCPLR B		X		X		X													
CEC IF & BB 1				X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
CEC IF & BB 2				X	X		X										X	X	X
CEC NOISE RCVR NOISE ALARM 1A											X				X			X	X
CEC NOISE RCVR NOISE ALARM 1B												X			X			X	X
CEC NOISE RCVR NOISE ALARM 2A																			X
CEC NOISE RCVR NOISE ALARM 2B																			X
RF MULTICOUPLER CAB A PUMP FAILURE		X																	
RF MULTICOUPLER CAB B PUMP FAILURE			X																
IF & BASEBAND CAB 1 (TRIB 1) BB ALARM A				X			X			X		X	X		X	X	X	X	X
IF & BASEBAND CAB 1 (TRIB 1) BB ALARM B					X			X			X	X		X	X			X	X
IF & BB CAB 1 IF & BB DRAWER A ALARM 1				X					X				X			X	X	X	
IF & BB CAB 1 IF & BB DRAWER A ALARM 2				X									X				X	X	
IF & BB CAB 1 IF & BB DRAWER B ALARM 1					X					X				X				X	
IF & BB CAB 1 IF & BB DRAWER B ALARM 2					X									X				X	
IF & BASEBAND CAB 2 (TRIB 2) BB ALARM A				X												X	X		X

Alarm location and name	Alarm indicator lights																			
IF & BASEBAND CAB 2 (TRIB 2) BB ALARM B					X															X
IF & BB CAB 2 IF & BB DRAWER A ALARM 1				X													X	X		
IF & BB CAB 2 IF & BB DRAWER A ALARM 2				X														X		
IF & BB CAB 2 IF & BB DRAWER B ALARM 1					X															
IF & BB CAB 2 IF & BB DRAWER B ALARM 2					X															
REFER TO RECEIVER TROULESHOOTING CHART, POMM 11-5820-574-15, AT STEP NUMBER:	3	3	37	37	4	4	1	1	5	5	15	15	25	25	5	5	5	29	23	23	13	32

Notes:

1. IF SINGLE SET OF ALARMS FOR ANY ONE CABINET, USE ALARM INDICATORS FOR CABINET 1.
2. IF MULTIPLE CABINET ALARMS, USE COMBINED ALARMS FOR CABINETS 1 AND 2.

(3) *Transmitting equipment.* The transmitting equipment consists of two transmitter cabinets, designated A and B. An equipment failure in either of these cabinets lights the corresponding XMTR A or XMTR B alarm indicator on the central alarm panel of central equipment cabinet B. Additional and more definitive alarm indicators are on the front panels of the frequency multiplier drawers and modulation drawers of the transmitter cabinets. Listed below are the alarm indicators of both transmitting equipment drawers. The list directs maintenance personnel to procedural steps of troubleshooting chart in POMM 11-5820-581-15.

Alarm indication	Step designation in POMM 11-5820-581-15
INTERLOCK COOLING FAILURE (frequency multiplier drawer).	A1 and A2
POWER OUTPUT FAILURE (frequency multiplier drawer).	B1 through B4
INTERLOCK COOLING FAILURE (modulator exciter drawer).	C1 and C2
POWER OUTPUT FAILURE (modulator exciter drawer).	D1 through D15
MODULATION FAILURE (modulator exciter drawer).	E1 through E6
LOCK ALARM (modulator exciter drawer).	F1

(4) *Power amplifying equipment.* The power amplifying equipment consists of two identical 1-kw power amplifiers. Summary alarm indicators, designated POWER AMPL A and POWER AMPL B, display the status of each cabinet on the central alarm panel of central equipment cabinet B. Each power amplifier incorporates automatic self-checking facilities which continuously monitor the status of the power amplifying circuitry. Using these facilities and other metering devices on the cabinet front panel, maintenance personnel can localize troubles to an individual circuit. Listed below are alarm indications and typical trouble symptoms of the power amplifying equipment. The list directs maintenance personnel to procedural steps of the troubleshooting chart in POMM 11-5820-603-15.

System	Step designation, POMM 11-5820-603-15
BEAM indicator lights red	1 through 1j
TIME DELAY lights yellow	2 through 2b
DC OVERLOAD indicator lights red	3 and 3a
AIR indicator lights red	4 through 4b
LOW RF indicator lights red	5 through 5c
ANTENNA MISMATCH indicator lights red	6 through 6d
AC INTERLOCK indicator lights red	7 through 7c
AC OVERLOAD indicator lights red	8 through 8c
FILAMENT indicator lights red	9 through 9e

(5) *Deicer monitor.* The deicer control and alarm assembly controls and continuously

monitors the deicer heaters. An array of alarm indicators on the monitor panel on the uppermost portion of the assembly provides displays of the status of each deicer heater. In addition to these alarm indicators, a summary alarm indicator, designated SUMMARY DEICER, on the central alarm panel of the central equipment cabinet B, provides an alarm indication when any of the deicer circuits fail. Should th SUMMARY DEICER indicator light red, de termine the malfunctioning deicer circuit vi the alarm indicators on the deicer monito panel. Then, take voltage and resistance meas urements of the components of the circuit, using figure 6–5 as a guide.

CHAPTER 6

DEMOLITION PROCEDURES AND CIRCUIT DIAGRAMS

Section I. DEMOLITION TO PREVENT ENEMY USE

6–1. Authority for Demolition

Demolition of the equipment will be accomplished only upon order of the commander. Use the destruction procedure outlined below to prevent further use of the equipment.

6–2. Methods of Destruction

Use any of the following methods to destroy the equipment:

a. Smash. Smash the controls, tubes, coils, switches, capacitors, transformers, and meter; use sledges, axes, handaxes, pickaxes, hammers, or crowbars.

b. Cut. Cut the output and power cord, and slash the rf shield; use axes, handaxes, or machetes.

Warning: **Be extremely careful when using incendiary devices; use these items only when the need is urgent.**

c. Burn. Burn the cords and technical manuals; use gasoline, kerosene, oil, flamethrowers, or incendiary grenades.

d. Bend. Bend the panels and cabinets.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches or foxholes, or throw them into streams.

APPENDIX A
REFERENCES

The following publications contain information applicable to the operation and maintenance of Radio Set AN/MRC–114(V) 1 through 6:

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310–7	U.S. Army Equipment Index of Modification Work Orders.
TM 5–4120–222–15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Air Conditioner; Compact Vertical 208 V, 3 Phase, 18,000 BTUH Cooling, 12,000 BTUH Heating (Trane Models) 50/60 Cycle-Model CE 20 VAL6, FSN 4120–973–4589, 400 Cycle-Model CE 20 VAL4, FSN 4120–858–5795 (American Air Filter Models) 50/60 Cycle Model CH–620–1, FSN 4120–909–0387 400 Cycle-Model CH–420–1, FSN 4120–909–0388.
TM 11–5057	Frequency Meter AN/USM–26.
TM 11–5895–686–12	Operator and Organizational Maintenance Manual: European Tropospheric Scatter-Army (ET–A) Command Control Console System.
TM 11–6625–214–10	Operator's Manual: Signal Generators AN/URM–52 and AN/URM–52A.
TM 11–6625–214–24	Organizational, DS, and GS, Maintenance Manual: Signal Generators AN/URM–52 and AN/URM–52A.
TM 11–6625–214–50	Depot Maintenance Manual: Signal Generator AN/URM–52 and AN/URM–52A.
TM 11–6625–320–12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U, ME–30C/U, and ME–30E/U.
TM 11–6625–320–35	DS, GS, and Depot Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME–30C/U.
TM 11–6625–366–15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS–352B/U.
TM 11–6625–433–15	Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Wattmeters AN/URM–98 and AN/URM–98A.
TM 11–6625–490–15	Operator, Organizational, Field and Depot Maintenance Manual: Preamplifier AM–1839B/USM.
TM 11–6625–495–15	Operator, Organizational, Field and Depot Maintenance Manual: Preamplifiers AM–1842/USM and AM–1842A/USM.
TM 11–6625–553–15	Operator, Organizational, Field and Depot Maintenance Manual: Preamplifier AM–3174A/USM.
TM 11–6625–584–15	Operator, Organizational, Field and Depot Maintenance Manual: Sweep Generators SG–367/U and SG–575/U, and Electric Model Radar (Catalog 865–A) and Model Radar (Catalog 865–AW).
TM 38–750	Army Equipment Record Procedures.

APPENDIX B

BASIC ISSUE ITEMS

Section I. INTRODUCTION

B-1. Scope

This appendix lists items comprising an operable equipment and those required for installation, operation, or operator's maintenance for Radio Sets AN/MRC-114(V) 1 through AN/MRC-114(V) 6.

B-2. Explanation of Columns

The following is a list of explanations of columns in Section II.

a. Source, Maintenance, and Recoverability Codes (SMR) Column.

(1) *Source code (S).* The selection status and source for the listed item is the first code indicated in this column. The source code used and its explanation is:

Code	Explanation
A	Applies to assemblies that are not procured or stocked as such but are made up of two or more units, each of which carries an individual stock number and description and is procured and stocked and can be assembled by units at indicated maintenance categories.

(2) *Maintenance code (M).* The lowest category of maintenance authorized to install the item is indicated by the second code in the column. The maintenance category codes and their explanations are:

Code	Explanation
C	Operator/Crew
O	Organizational Maintenance

(3) *Recoverability code (R).* The recoverability code is the third code in the column. It indicates whether unserviceable items should be returned for recovery or salvage. Recoverability code and its explanation is as follows:

Note. When no code is indicated in the recoverability column, the part will be considered expendable.

Code	Explanation
R	Applies to repair parts and assemblies that are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.

b. Federal Stock Number Column. This column indicates the Federal stock number for the item.

c. Description Column. This column includes the Federal item name and any additional description of the item which may be required. A part number or other reference number is followed by the applicable five-digit Federal Supply Code for Manufacturers. When required to indicate that the part is used on the models, or serially numbered groups so identified, the numbers 1, 2, 3, 4, etc. are placed under the heading *Usable on Code.* An explanation of the codes used precedes the first item in section II of the basic issue items list.

d. Unit of Measure Column. The unit used as a basis of measure (e.g., ea, pr, ft, yd, etc.) is given in this column.

e. Quantity Incorporated in Unit Column. The total quantity of the item used in the equipment is given in this column.

f. Quantity Furnished with Equipment Column. This column lists the quantity of the item supplied for initial operation of the equipment and/or the quantities authorized to be kept on hand by the operator for maintenance of the equipment.

g. Illustrations Column.

(1) *Figure number (a).* Not used.

(2) *Item No. or reference designation (b).* The reference designation and/or item number callout used to reference the item in the illustration appears in this column.

B-3. Federal Supply Codes

This paragraph lists the Federal supply code and the associated manufacturer's name.

Code	Manufacturer
16070	Automatic Sprinkler Corp. of America Davis Emergency Equipment Division
43942	Norcar Mfg. Co. Inc.
60532	Trane Co., The
90348	ITT Federal Laboratories Division of International Telephone and Telegraph Corp.

SECTION II BASIC ISSUE ITEMS

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION Reference Number & Mfr Code	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) QTY FURN WITH EQUIP	(7) ILLUSTRATIONS (a) FIG. NO.	(7) ILLUSTRATIONS (b) ITEM NO. OR REFERENCE DESIGNATION
	5820-949-8882	RADIO SET AN/MRC-114(V) 1: NUS6260G1; 90348 (This item is nonexpendable)						
	5820-951-5475	RADIO SET AN/MRC-114(V) 2: NUS6260G5; 90348 (This item is nonexpendable)		ea				
	5820-951-5441	RADIO SET AN/MRC-114(V) 3: NUS6260G13; 90348 (This item is nonexpendable)		ea				
	5820-949-8886	RADIO SET AN/MRC-114(V) 4: NUS6260G22; 90348 (This item is nonexpendable)		ea				
	5820-951-5399	RADIO SET AN/MRC-114(V) 5: NUS6260G25; 90348 (This item is nonexpendable)		ea				
	5820-949-8890	RADIO SET AN/MRC-114(V) 6: NUS6260G24; 90348 (This item is nonexpendable)		ea				
		Note: Usable on Code 1 refers to AN/MRC-114(V) 1; 2 refers to AN/MRC-114(V) 2; 3 refers to AN/MRC-114(V) 3; 4 refers to AN/MRC-114(V) 4; 5 refers to AN/MRC-114(V) 5; 6 refers to AN/MRC-114(V) 6.						
		TECHNICAL MANUAL TM 11-5820-758-15		ea	1	1		
		Requisition through pinpoint account number if assigned; otherwise through nearest Adjutant General Facility.						
		For technical manuals the quantity indicates the maximum number of copies authorized for packing (or issue) with the equipment. Where a number of these equipments are concentrated in a small area, the quantity on hand may be reduced to the minimum actual requirements as determined by the commanding officer of the unit.						
A-C-R		AIR CONDITIONER: MAC6V20; 60532	1,2,3,4,5,6	ea	3	3		
A-C-R	5820-949-5267	AMPLIFIER-MIXER AM-4633/GRC: 8272G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-949-5266	AMPLIFIER-MIXER AM-4634/GRC: 8312G1; 90348	1,2,3,5,6 4	ea ea	2 1	2 1		
A-C-R	5820-054-9162	AMPLIFIER-OSCILLATOR AM-4404/GRC: NUS3753G6; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-911-3679	AMPLIFIER-OSCILLATOR AM-4405/GRC: NUS3753G7; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-918-3676	AMPLIFIER-POWER SUPPLY AM-4419/GRC: NUS8013G2; 90348	1,2,3,4,5	ea	2	2		
A-C-R	5820-910-3773	AMPLIFIER PARAMETTIC AM-4410/GRC: 6580G2; 90348	1,2,3,5	ea	2	2		
A-C-R	5820-949-2624	CABINET, ELECTRICAL EQUIPMENT CY-6027/MRC-114(V): 8023G1; 90348	1,2,3,4,5	ea	2	2		
A-C-R	5820-949-2645	CABINET, ELECTRICAL EQUIPMENT CY-6028/MRC-114(V) 8023G2; 90348	6	ea	2	2		
A-C-R	5820-949-2655	CABINET, ELECTRICAL EQUIPMENT CY-6029/MRC-114(V): 8025G1; 90348	1 2 3 4,6 5	ea ea ea ea ea	8 8 5 3 2	8 8 5 3 2		
A-C	5995-926-6404	CABLE ASSEMBLY, RADIOFREQUENCY CG-1653B/U (7 ft 3 in): 233395403; 90348	6	ea	1	1		
A-C	5995-985-8358	CABLE ASSEMBLY, RADIOFREQUENCY CG-1653B/U (9 ft 2 in): 233395404; 90348	6	ea	1	1		
A-C	5995-926-6403	CABLE ASSEMBLY, RADIOFREQUENCY CG-1906/U (15 ft): 228911705; 90348	1 2,3,4,5	ea ea	1 2	1 2		W123
A-C	5995-905-2452	CABLE ASSEMBLY, RADIOFREQUENCY CG-2622/U (6 ft 5 in): 228911502; 90348	6	ea	1	1		
A-C	5995-905-2455	CABLE ASSEMBLY, RADIOFREQUENCY CG-3045/U (7 ft 5 in): 228911802; 90348	6	ea	1	1		
A-C	5995-905-2456	CABLE ASSEMBLY, RADIOFREQUENCY CG-3045/U (7 ft 7 in): 228911801; 90348	6	ea	1	1		
A-C	5995-948-2609	CABLE ASSEMBLY, RADIOFREQUENCY CG-3169/U (7 ft 3 in): 228911603; 90348	1,2,3,4,5	ea	1	1		W161
A-C	5995-948-2610	CABLE ASSEMBLY CG-3169/U (9 ft 1 in): 228911604; 90348	1,2,3,4,5	ea	1	1		W163

SECTION II BASIC ISSUE ITEMS (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION Reference Number & Mfr Code	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) QTY FURN WITH EQUIP	(7) ILLUSTRATIONS (a) FIG. NO.	(7) ILLUSTRATIONS (b) ITEM NO. OR REFERENCE DESIGNATION
A-C-R	5995-905-2973	CABLE ASSEMBLY, RADIOFREQUENCY, CG-3170/U (2 ft 1 in): 2330621G2; 90348	1,2,3,4,5	ea	1	1		W121
A-C	5995-947-9682	CABLE ASSEMBLY, RADIOFREQUENCY, CG-3310/U (15 ft): 238328BG2; 90348	6	ea	2	2		
A-C	5995-926-8278	CABLE ASSEMBLY, RADIOFREQUENCY CX-11633/U (2 ft): 2382577G1; 90348	1,2,3,4,5	ea	2	2		W4
A-C	5995-950-6739	CABLE ASSEMBLY, RADIOFREQUENCY CX-11634/U (2 ft): 238266?G3; 90348	1 2 3 4,6	ea ea ea ea	6 5 3 1	6 5 3 1		W20
A-C	5995-951-6653	CABLE ASSEMBLY, RADIOFREQUENCY CX-11635/U:(2 ft 6 in): 238262510; 90348	1 2 3,6 4	ea ea ea ea	6 5 3 1	6 5 3 1		W-19
A-C		CHAIR FOLDING: 534 LIGHT GREY; 43942	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-949-5270	CONTROL-ALARM C-8038/MRC-114(V); 6263G1; 90348	1	ea	1	1		
A-C-R	5820-949-5269	CONTROL-ALARM C-8039/MRC-114(V); 6263G2; 90348	2	ea	1	1		
A-C-R	5820-949-5268	CONTROL-ALARM C-8040/MRC-114(V); 6263G4; 90348	3	ea	1	1		
A-C-R	5820-949-5272	CONTROL-ALARM C-8041/MRC-114(V): 6263G6; 90348	4	ea	1	1		
A-C-R	5820-949-5271	CONTROL-ALARM C-8042/MRC-114(V): 6263G7; 90348	5	ea	1	1		
A-C-R	5820-949-8897	CONSOLE COMMUNICATION CONTROL OA-8149/MRC-114(V): 5972-5G1; 90348	1	ea	1	1		
A-C-R	5820-949-8909	CONSOLE COMMUNICATION CONTROL OA-8150/MRC-114(V): NUS5972-5G2; 90348	2	ea	1	1		
A-C-R		CONSOLE COMMUNICATION CONTROL OA-8151/MRC-114(V): NUS5972-5G4; 90348	3	ea	1	1		
A-C-R		CONSOLE COMMUNICATION CONTROL OA-8152/MRC-114(V): NUS5972-5G6; 90348	4,6	ea	1	1		
A-C-R	5820-949-8930	CONSOLE COMMUNICATION CONTROL OA-8153/MRC-114(V): NUS5972-5G7; 90348	5	ea	1	1		
A-C-R	5820-949-8941	CONSOLE COMMUNICATION CONTROL OA-8154/MRC-114(V): NUS5972-6G1; 90348	1,2,3,4,5,6	ea	1	1		
A-C-R	5820-911-2273	CONTROL, ELECTRICAL FREQUENCY C-6741/GRC: NUS6973G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5915-226-6229	FILTER BAND PASS F-1046/GRC: NUS5313G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5915-912-3431	FILTER LOW PASS F-1044/GRC: 8443G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R		FIRST AID KIT: 431D; 16090	1,2,3,4,5,6	ea	1	1		
A-C-R	4210-950-2929	FIRE EXTINGUISHER	1,2,3,4,6	ea	2	2		
A-C-R	5820-082-3533	FREQUENCY MULTIPLIER RF-131(P)/GRC-66(V): 2338165; 90348	1,2 3,4,5,6	ea ea	2 1	2 1		
A-C-R	5820-225-0193	FREQUENCY MULTIPLIER RF-190/GRC: NUS5314G3; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-911-2291	FREQUENCY MULTIPLIER RF-191/GRC: NUS4152G5; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-911-2281	MODULATOR, RADIO TRANSMITTER MD-661/GRC: NUS3754G4; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-949-2638	MULTICOUPLER, RADIOFREQUENCY CU-1610/MRC-114(V): 8020G1; 90348	1	ea	4	4		
A-C-R	5820-949-5275	MULTICOUPLER, RADIOFREQUENCY CU-1611/MRC-114(V): 8020G2; 90348	2	ea	4	4		
A-C-R	5820-949-2618	MULTICOUPLER, RADIOFREQUENCY CU-1612/MRC-114(V): 8020G4; 90348	3	ea	4	4		
A-C-R	5820-949-5274	MULTICOUPLER, RADIOFREQUENCY CU-1613/MRC-114(V): 8020G6; 90348	4,6	ea	4	4		
A-C-R	5820-949-5273	MULTICOUPLER, RADIOFREQUENCY CU-1614/MRC-114(V): 8020G7; 90348	5	ea	4	4		

SECTION II BASIC ISSUE ITEMS (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION Reference Number & Mfr Code	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) QTY FURN WITH EQUIP	(7) ILLUSTRATIONS (a) FIG. NO.	(7) ILLUSTRATIONS (b) ITEM NO. OR REFERENCE DESIGNATION
A-C-R	5820-889-1486	POWER DISTRIBUTION PANEL PP-3594(P)/GRC-66(V): 2338176; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-889-1487	POWER SUPPLY PP-2046/GRC-66(V): 2288026G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-889-1488	POWER SUPPLY PP-3789(P)/GRC-66(V): 2338166; 90348	1 2 3 4,6 5	ea ea ea ea ea	18 16 12 8 6	18 16 12 8 6		
A-C-R	5820-912-0379	POWER SUPPLY PP-4432/GRC: NUS8797G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-911-2288	POWER SUPPLY PP-4433/GRC: NUS8797G2; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5820-910-4465	RACK, ELECTRICAL EQUIPMENT MT-3551/GRC: NUS5952G5; 90348	6	ea	1	1		
A-C-R	6110-912-7537	REGULATOR, VOLTAGE CN-1087/GRC: 8258G1; 90348	1,2,3,4,5,6	ea	1	1		
A-C-R		RACK, ELECTRICAL EQUIPMENT MT-3553/GRC: NUS5952G7; 90348	6	ea	1	1		
A-C-R	5820-910-4668	RACK ELECTRICAL EQUIPMENT MT-3554/GRC: NUS5952G8; 90348	1,2,3,4,5	ea	1	1		
A-C-R	5820-910-4466	RACK ELECTRICAL EQUIPMENT MT-3552/GRC: NUS5952G6; 90348	1,2,3,4,5	ea	1	1		
A-C-R	5820-911-2377	RECEIVER RADIO OA-7718/GRC: 2380970G1; 90348	1,2,3,4,5,6	ea	2	2		
A-C-R	5985-905-5998	SWITCH, RADIOFREQUENCY TRANSMISSION LINE SA-994/GRC: NUS5959G1; 90348	1,2,3,4,5	ea	1	1		
A-C-R	5820-082-3543	SWITCH, RADIOFREQUENCY TRANSMISSION LINE SA-995/GRC: NUS5959G2; 90348	5	ea	1	1		
A-C-R	2330-797-7405	TRAILER, VAN V-389/MRC-114(V)	1,2,3,4,5,6	ea	1	1		
A-C-R	5950-999-3864	TRANSFORMER ASSEMBLY TF-499/MRC-114(V): 8026G1; 90348	1 2 3 4,6 5	ea ea ea ea ea	8 7 5 3 2	8 7 5 3 2		
A-C-R	5820-911-2294	TRANSMITTER T-1010(P)/GRC: 2386610G1; 90348	1 2,3,4,5,6	ea ea	2 1	2 1		
		ACCESSORIES, TOOLS AND TEST EQUIPMENT						
A-O		KIT ACCESSORY: 2337737G1; 90348	1,2,3,4,5,6	ea	1	1		
A-O		TOOL KIT: 2338515G1; 90348	1,2,3,4,5,6	ea	1	1		
		NO BASIC ISSUE ITEMS ARE MOUNTED IN OR ON THE EQUIPMENT						

INDEX

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

USASA (2)
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CofSptS (1)
ACSC-E (2)
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USACDCCEA (Ft Huachuca) (1)
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Gen Dep (USAREUR) (5)
Sig Sec, Gen Dep (USAREUR) (5)
Sig Dep (USAREUR) (12)
Sig FLDMS (USAREUR) (2)

ARNG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1968—844440/106

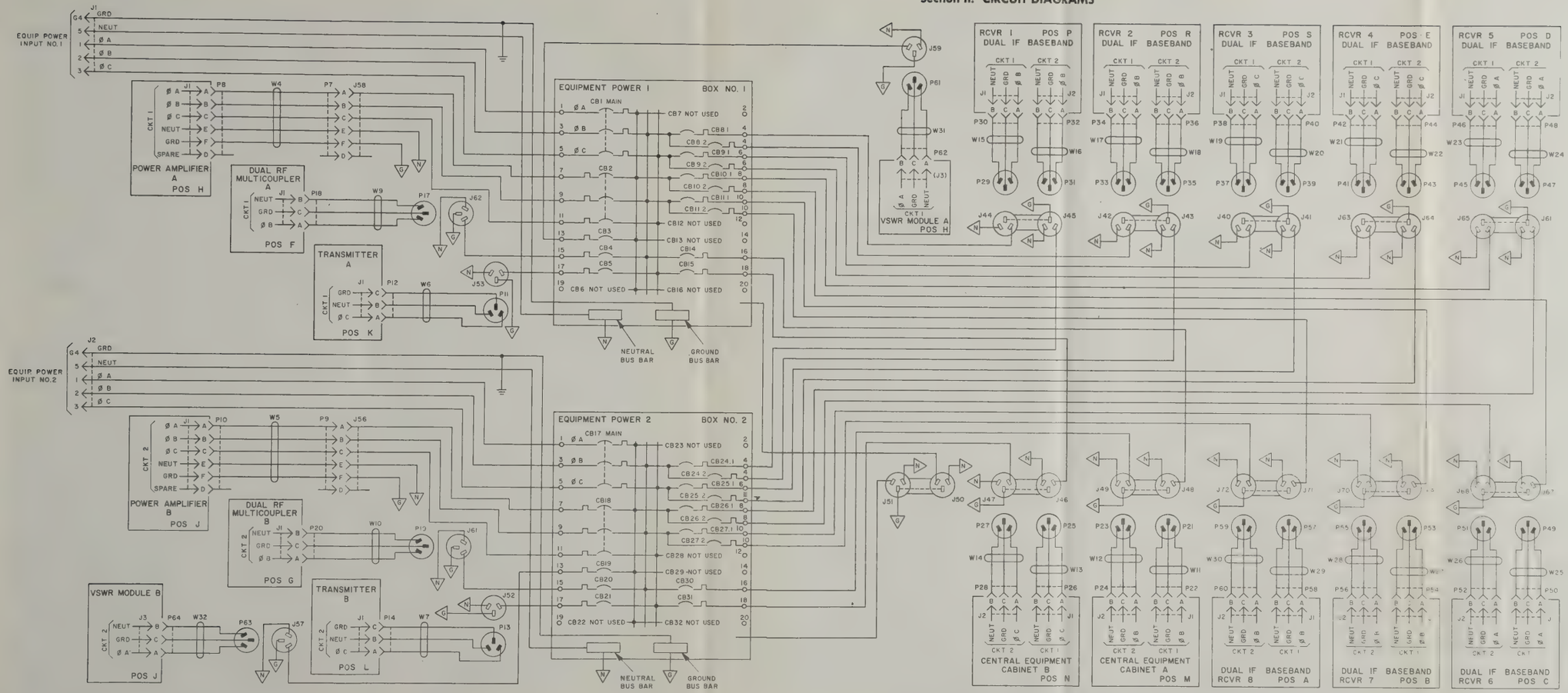
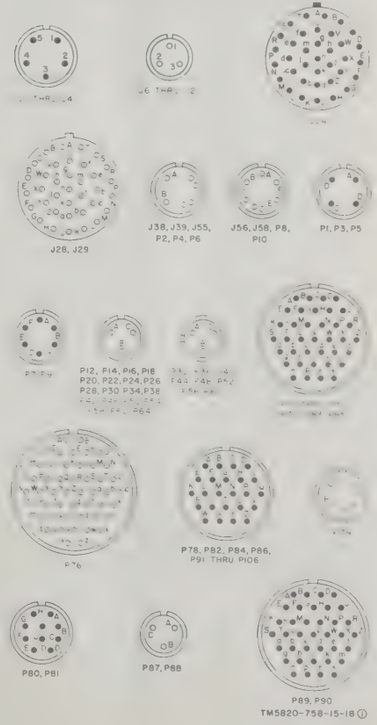


Figure 6-1(1). Nodal point radio set van, schematic diagram.

NOTES:
1. VOLTAGE STANDING WAVE RATIO (VSWR).
2. FUNCTIONS ARE IDENTICAL IN ALL DUAL IF BASEBAND RECEIVERS, EXCEPT FOR CHANNELS REFERENCED AS INDICATED.
3. ▭ INDICATES EQUIPMENT MARKING.
4. RECEPTACLES VIEWED FROM PIN OR RECEPTACLE END.



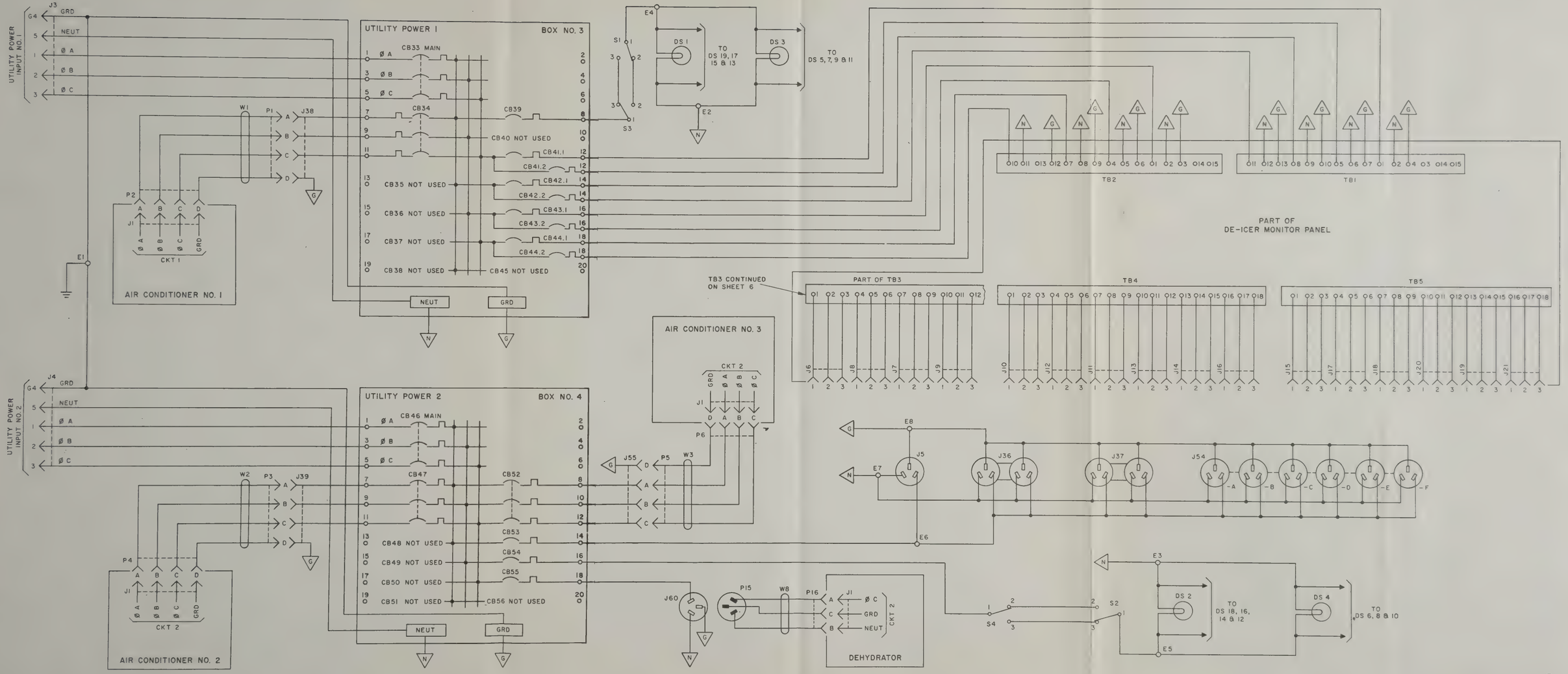


Figure 6-1(2). Nodal point radio set van, schematic diagram (sheet 2 of 3).

TM5820-758-15-18 (2)

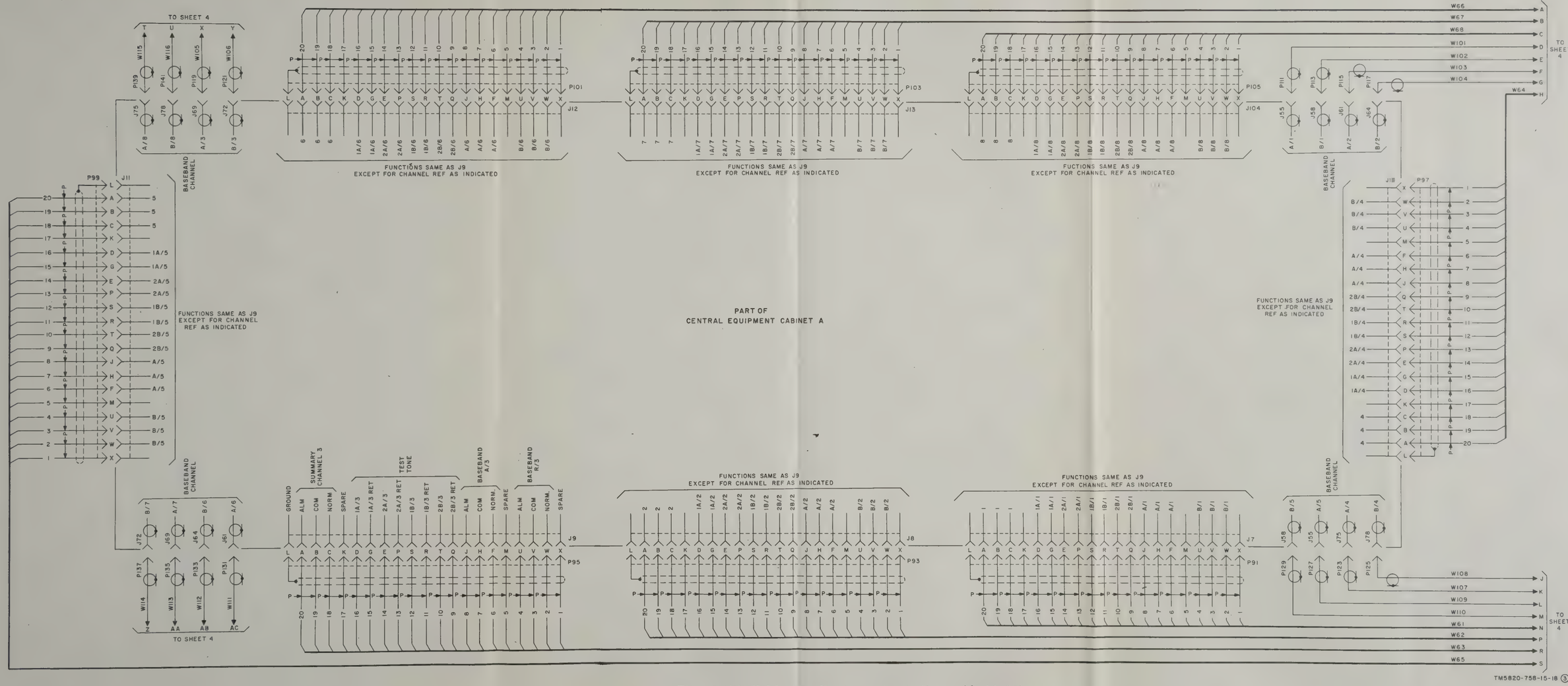


Figure 6-1(3). Nodal point radio set van, schematic diagram (sheet 3 of 8).

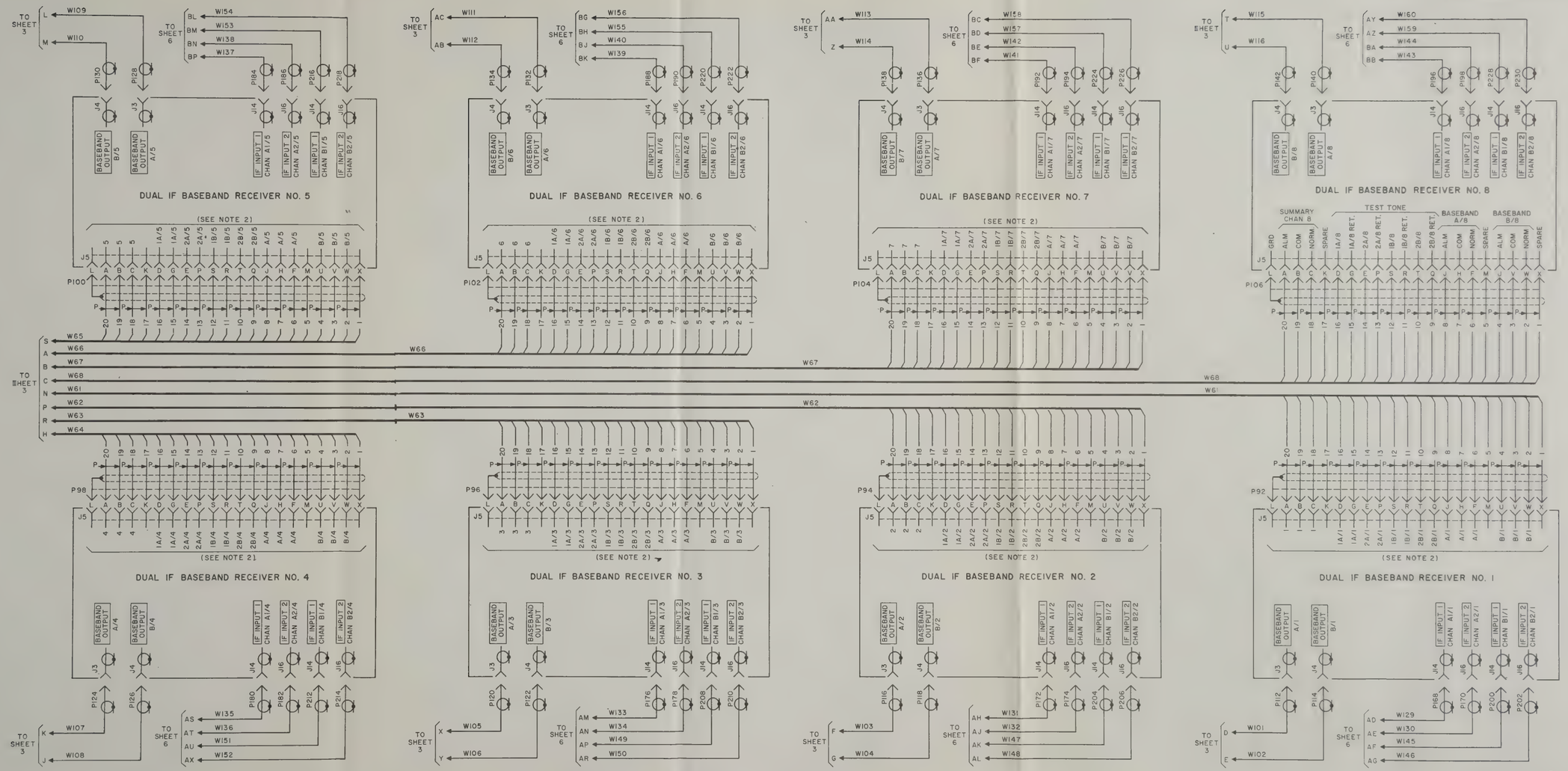
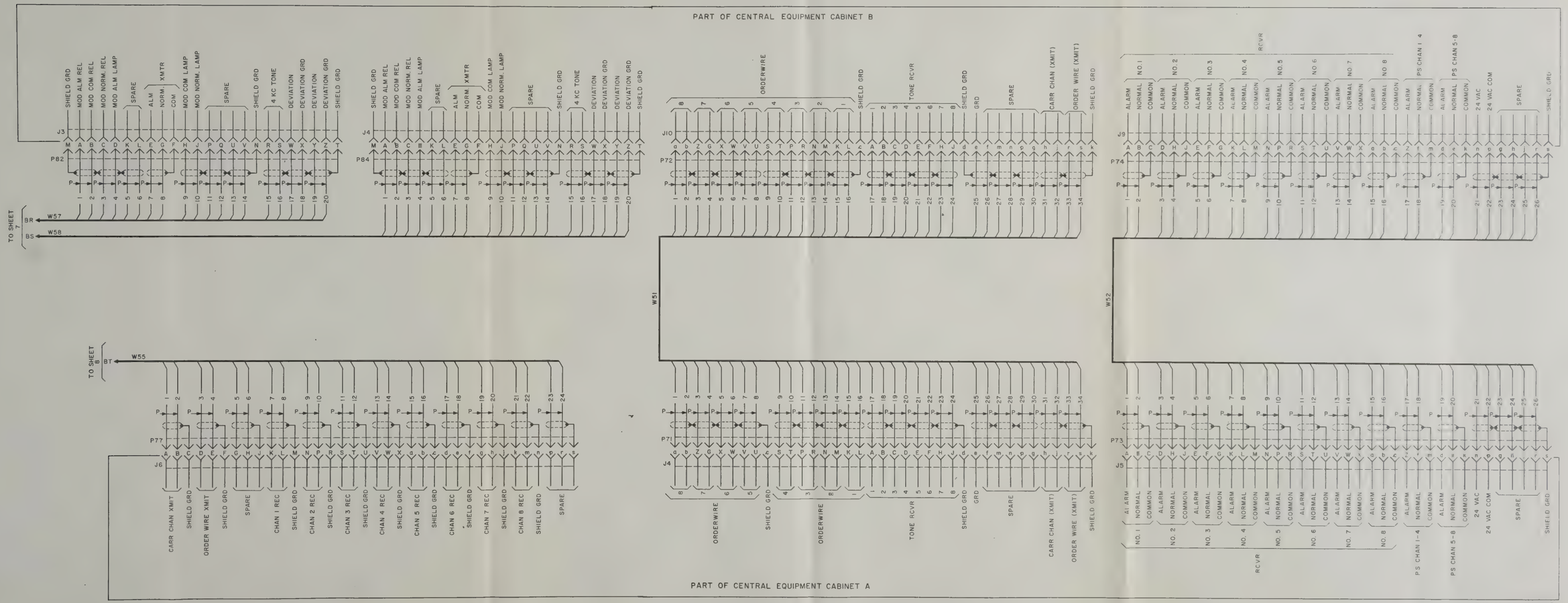


Figure 6-1(4). Nodal point radio set van, schematic diagram (sheet 4 of 8).



TM5820-758-15-18 (S)

Figure 6-1(5). Nodal point radio set van, schematic diagram (sheet 5 of 8).

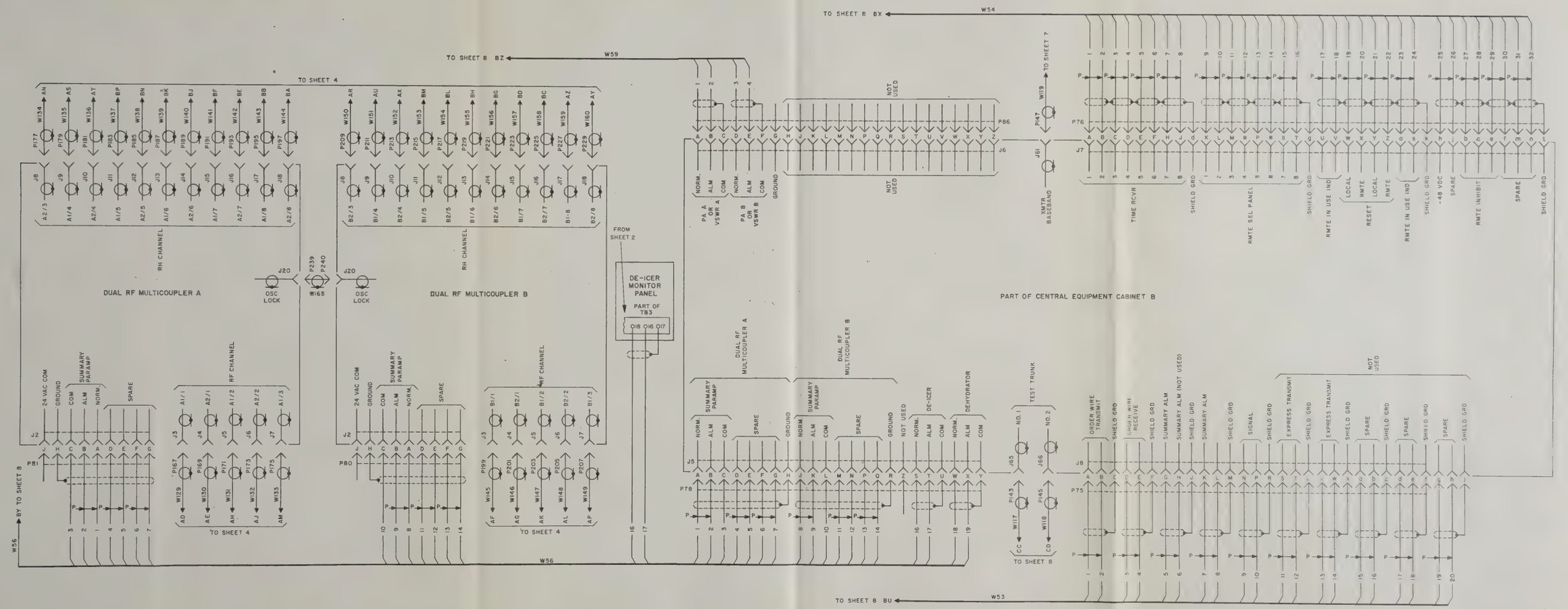


Figure 6-1(6). Nodal point radio set van, schematic diagram (sheet 6 of 8).

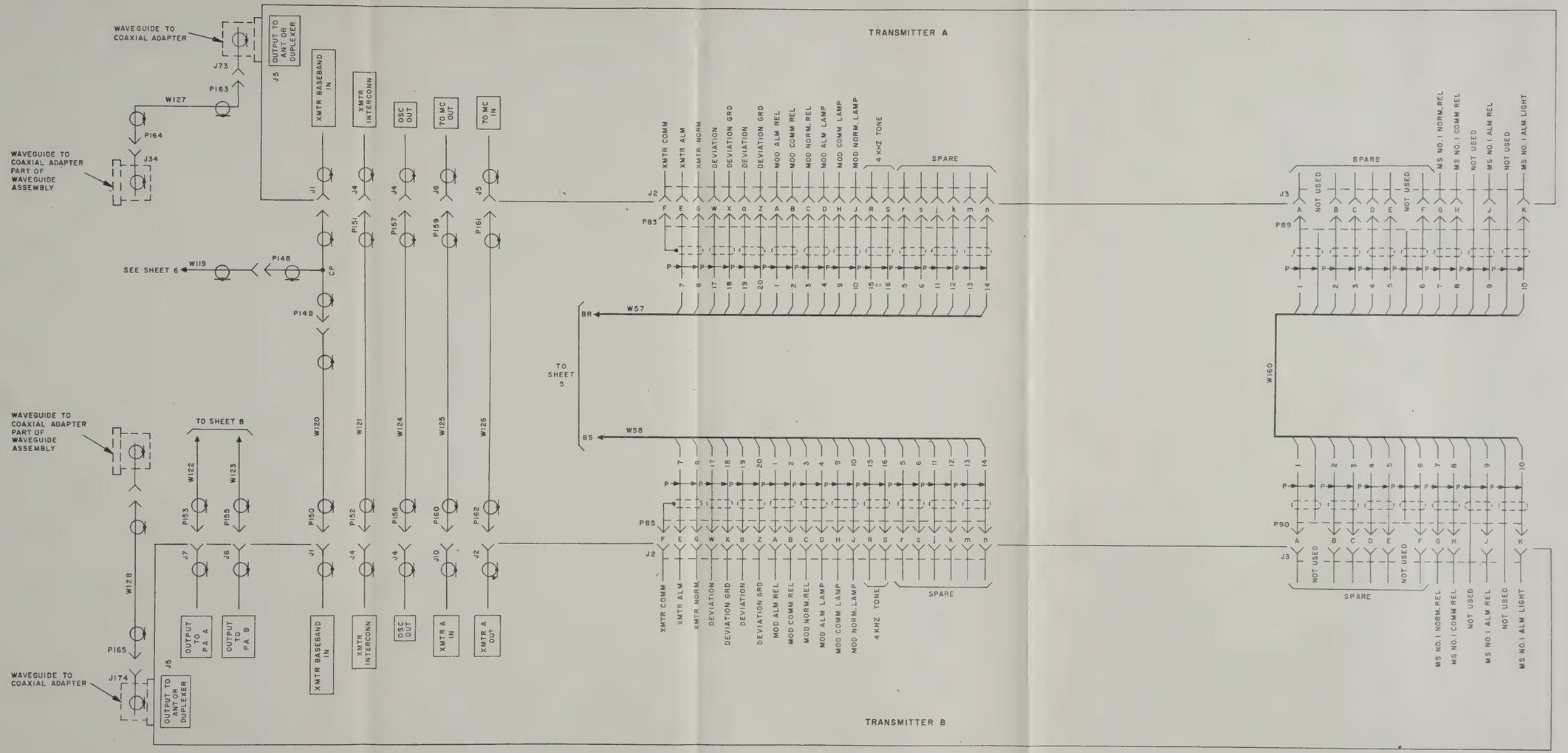
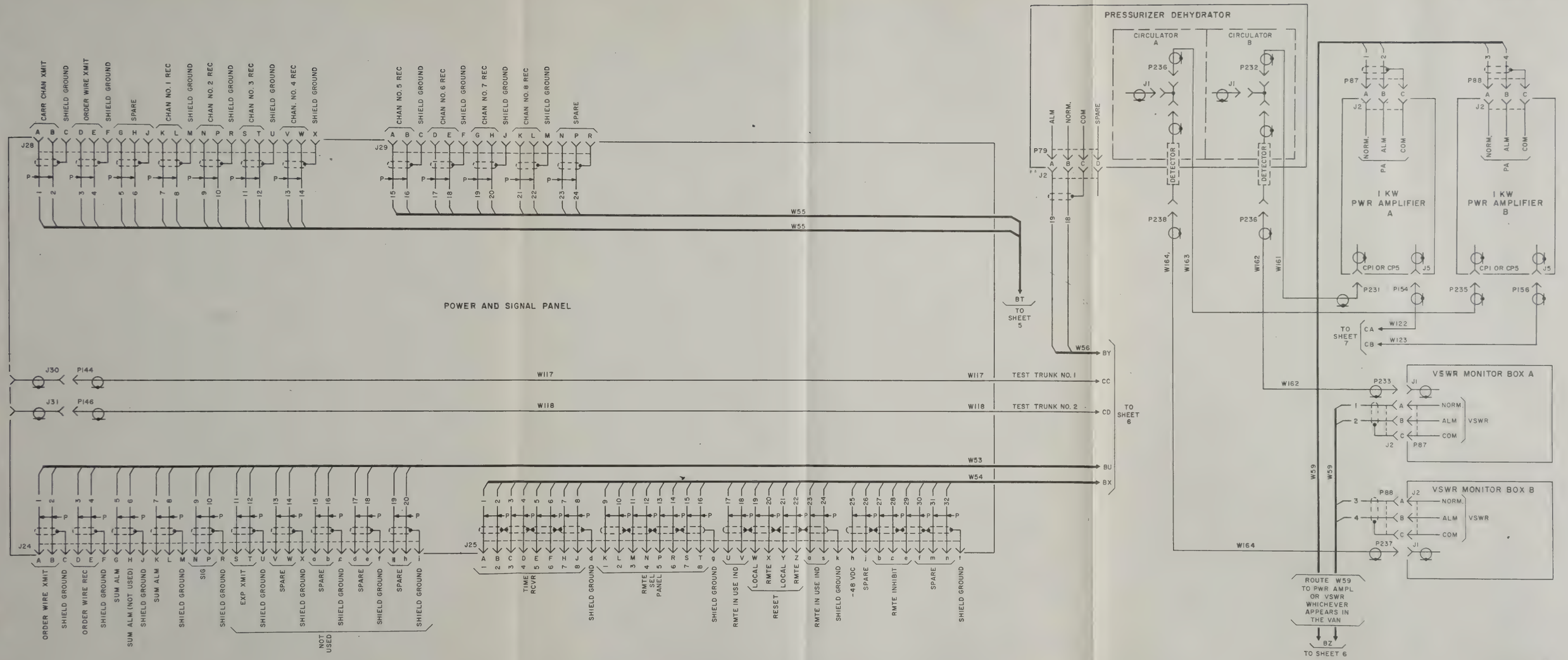


Figure 6-1(7). Nodal point radio set van, schematic diagram (sheet 7 of 8).



TM5820-758-15-18 (8)

Figure 6-1(8). Nodal point radio set van, schematic diagram (sheet 8 of 8).

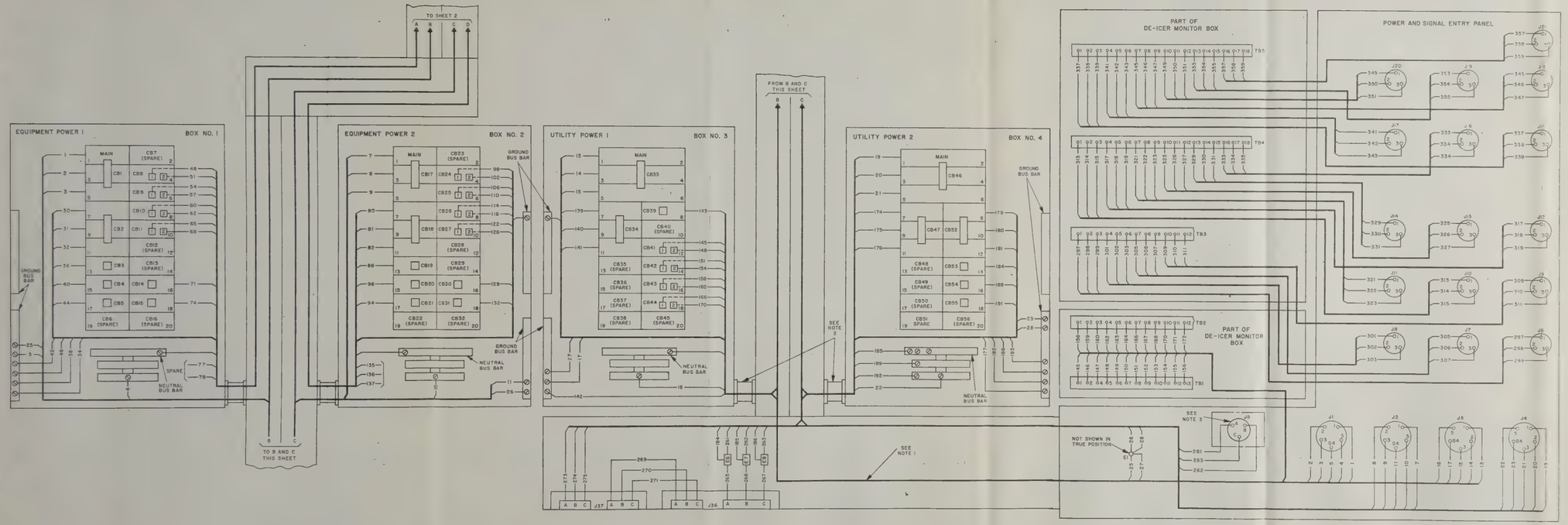


Figure 6-2(1). Nodal point radio set van, interconnection diagram.

CABLES

REF. SYMBOL	NOMENCLATURE
W1 (TRANSMITTER)	RG-214/U (36')
W2 (1 WATT VAN)	RG- 59B/U (78')
W3	RG- 59B/U (77')
W1 (RECEIVER)	RG- 62A/U (29
W1 (R) & W3 (R)	RG- 328U (52')
W2 (R) & W4 (R)	RG-214/U (33')
W101 & W102	RG- 59 (121')
W103 & W104	RG- 59B/U (156')
W105 & W106	RG- 59B/U (180')
W107 & W108	RG- 59B/U (189')
W109 & W110	RG- 59B/U 226'
W111 & W112	RG- 59B/U (252')
W113 & W114	RG- 59B/U (276')
W115, W116 & W119	RG- 59B/U 300'
W117 & W118	RG- 59B/U 324'
W120	RG- 62A/U (108'
W121	RG-214/U (24')
W122 (1 KW VAN)	RG-214/U (102'
W123	RG-214/U (118')
W124	RG- 62A/U (77')
W125	RG- 59B/U (90')
W126 (1 WATT VAN)	RG- 59B/U (93.5'
W127	RG-217/U (92')
W 28	RG- 2.7 U (102'
W129, W130, W145 & W146	RG- 59B/U (258')
W131, W132, W147 & W148	RG- 59B/U (288')
W133, W134, W149 & W150	RG- 59B/U (336'
W135, W136, W151 & W152	RG- 59B/U (125')
W137, W138, W153 & W154	RG- 59B/U (168')
W139, W140, W155 & W156	RG- 59B/U (192'
W141, W142, W157 & W158	RG- 59B/U (216')
W143, W144, W159 & W160	RG- 59B/U (240'
W161 (1 KW VAN)	RG-214/U (41')
W162 (1 WATT VAN)	RG- 58C/U (84')
W163 (1 KW VAN)	RG-214/U (65')
W164 (1 WATT VAN)	RG- 58C/U (90'
W165	RG- 62A/U 48

NOTES

1. BASELINES SHOWN ON SHEETS 1 THROUGH 3 DO NOT REPRESENT CABLES
2. ANY ONE OF THE 3 ENTRIES INTO EACH BREAKER BOX MAY BE USED FOR WIRING CONVENIENCE
3. BRASS TERMINALS ARE POWER (DESIGNATED A WHITE METAL TERMINALS ARE NEUTRAL (DESIGNATED B) AND GREEN TERMINA ARE GROUND (DESIGNATED C)
4. EQUIPMENT OR DUCT MOUNTED ON VAN WALL
5. DUCT MOUNTED IN VAN CEILING
6. THESE PLUGS AND JACKS ARE NOT SHOWN IN PROPER RELATIVE POSITIONS

VOLTAGE STANDING WAVE RATIO (VSWR)

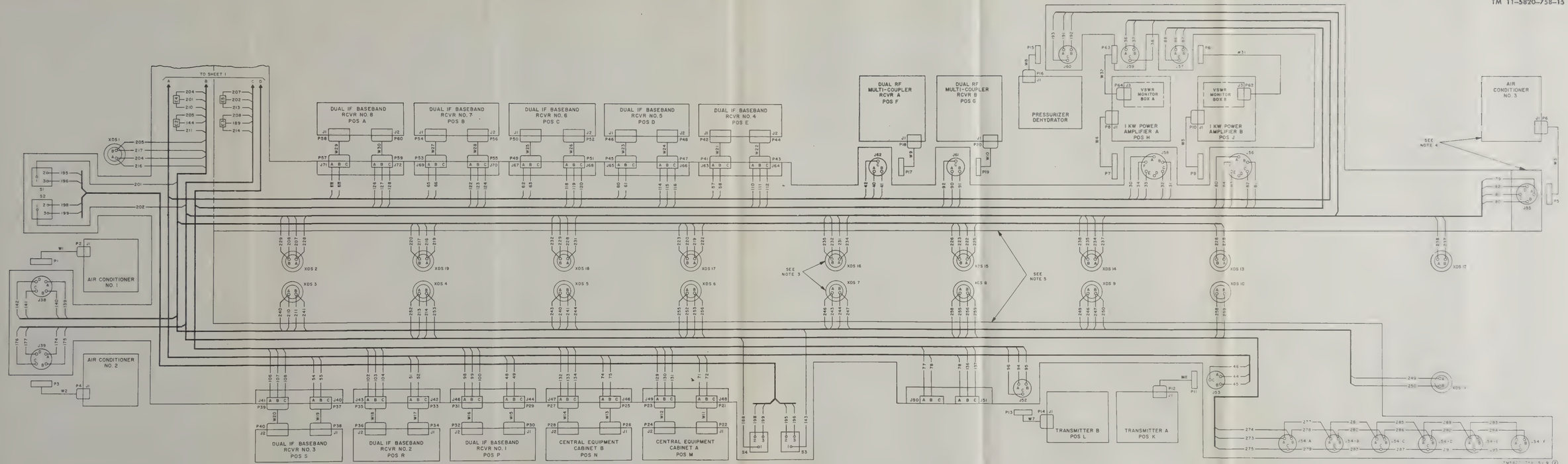


Figure 6-2(2). Nodal point radio set van, interconnection diagram (sheet 2 of 3).

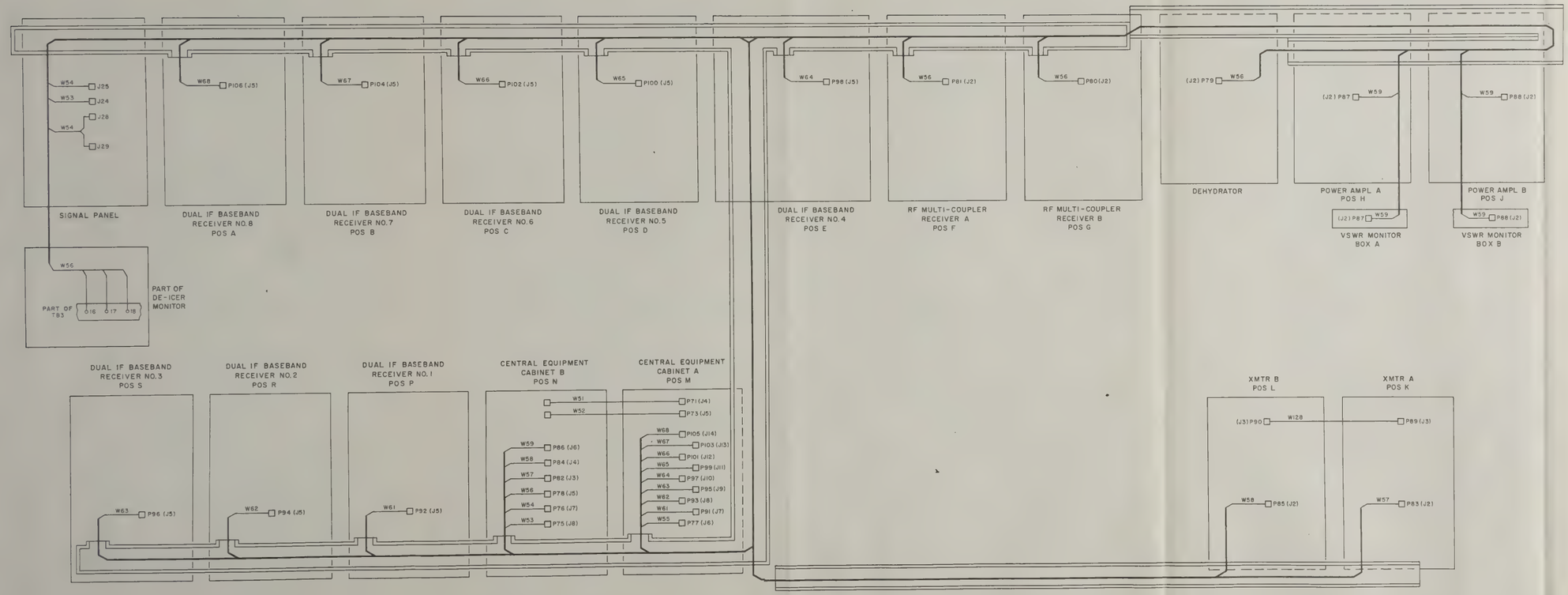
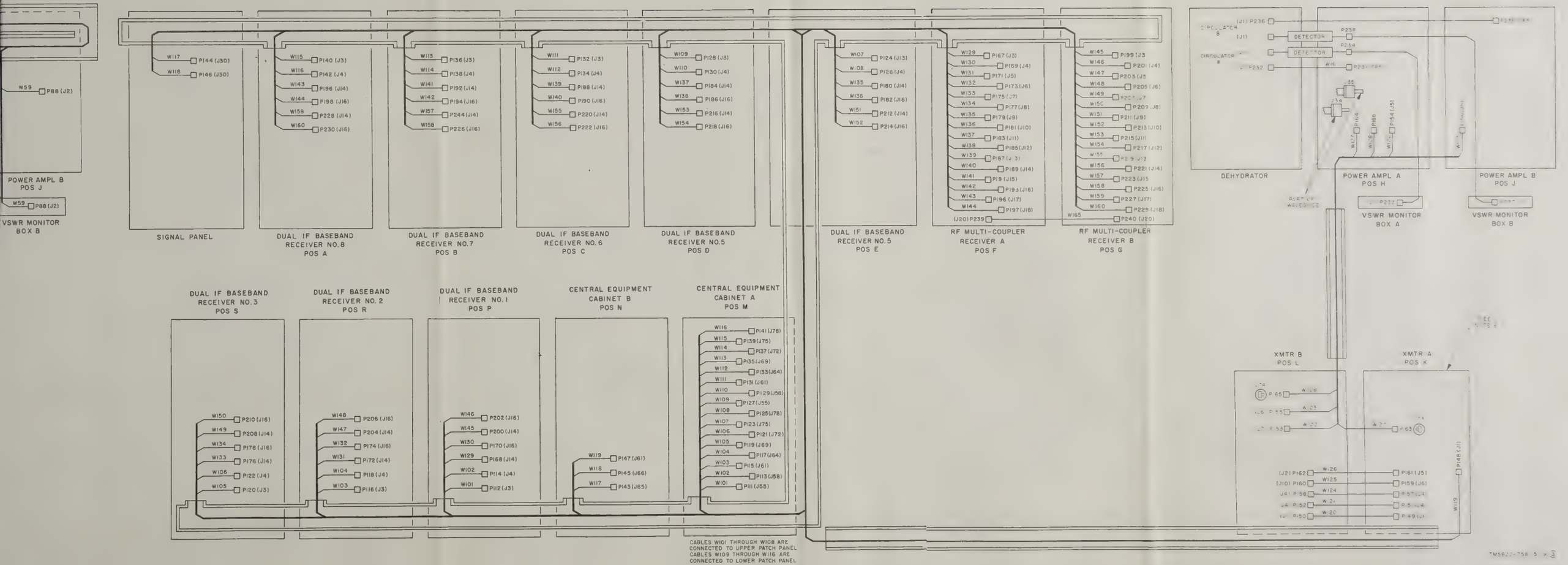


Figure 6-2(3). Nodal point radio set van, interconnection diagram (sheet 3 of 3).


W59 P88 (J2)
POWER AMPL B POS J
W59 P88 (J2)
VSWR MONITOR BOX B
W117 P144 (J30)
W118 P146 (J30)
SIGNAL PANEL
W115 P140 (J3)
W116 P142 (J4)
W143 P196 (J14)
W144 P198 (J16)
W159 P228 (J14)
W160 P230 (J16)
DUAL IF BASEBAND RECEIVER NO. 8 POS A
W113 P136 (J3)
W114 P138 (J4)
W141 P192 (J14)
W142 P194 (J16)
W157 P244 (J14)
W158 P226 (J16)
DUAL IF BASEBAND RECEIVER NO. 7 POS B
W111 P132 (J3)
W112 P134 (J4)
W139 P188 (J14)
W140 P190 (J16)
W155 P220 (J14)
W156 P222 (J16)
DUAL IF BASEBAND RECEIVER NO. 6 POS C
W109 P128 (J3)
W110 P130 (J4)
W137 P184 (J14)
W138 P186 (J16)
W153 P216 (J14)
W154 P218 (J16)
DUAL IF BASEBAND RECEIVER NO. 5 POS D
W107 P124 (J13)
W108 P126 (J4)
W135 P180 (J14)
W136 P182 (J16)
W151 P212 (J14)
W152 P214 (J16)
DUAL IF BASEBAND RECEIVER NO. 5 POS E
W129 P167 (J3)
W130 P169 (J4)
W131 P171 (J5)
W132 P173 (J6)
W133 P175 (J7)
W134 P177 (J8)
W135 P179 (J9)
W136 P181 (J10)
W137 P183 (J11)
W138 P185 (J12)
W139 P187 (J 3)
W140 P189 (J14)
W141 P19 (J15)
W142 P193 (J16)
W143 P196 (J17)
W144 P197 (J18)
(J20) P239
RF MULTI-COUPLER RECEIVER A POS F
W145 P199 (J3
W146 P201 (J4)
W147 P203 (J5
W148 P205 (J6)
W149 P207 (J7
W150 P209 (J8)
W151 P211 (J9)
W152 P213 (J10)
W153 P215 (J11)
W154 P217 (J12)
W155 P2 9 (J13
W156 P221 (J14)
W157 P223 (J15
W158 P225 (J16)
W159 P227 (J17)
W160 P229 (J18)
W165 P240 (J20)
RF MULTI-COUPLER RECEIVER B POS G
(J1) P236
CIRCULATOR B (J1)
DETECTOR
DETECTOR
P239
P234
W16
P232
DEHYDRATOR
POWER AMPL A POS H
POWER AMPL B POS J
VSWR MONITOR BOX A
VSWR MONITOR BOX B
DUAL IF BASEBAND RECEIVER NO. 3 POS S
W150 P210 (J16)
W149 P208 (J14)
W134 P178 (J16)
W133 P176 (J14)
W106 P122 (J4)
W105 P120 (J3)
DUAL IF BASEBAND RECEIVER NO. 2 POS R
W148 P206 (J16)
W147 P204 (J14)
W132 P174 (J16)
W131 P172 (J14)
W104 P118 (J4)
W103 P116 (J3)
DUAL IF BASEBAND RECEIVER NO. 1 POS P
W146 P202 (J16)
W145 P200 (J14)
W130 P170 (J16)
W129 P168 (J14)
W102 P114 (J4)
W101 P112 (J3)
CENTRAL EQUIPMENT CABINET B POS N
W119 P147 (J61)
W118 P145 (J66)
W117 P143 (J65)
CENTRAL EQUIPMENT CABINET A POS M
W116 P141 (J78)
W115 P139 (J75)
W114 P137 (J72)
W113 P135 (J69)
W112 P133 (J64)
W111 P131 (J61)
W110 P129 (J58)
W109 P127 (J55)
W108 P125 (J78)
W107 P123 (J75)
W106 P121 (J72)
W105 P119 (J69)
W104 P117 (J64)
W103 P115 (J61)
W102 P113 (J58)
W101 P111 (J55)
CABLES W101 THROUGH W108 ARE CONNECTED TO UPPER PATCH PANEL
CABLES W109 THROUGH W116 ARE CONNECTED TO LOWER PATCH PANEL
XMTR B POS L
XMTR A POS K
P 65
P 55
P 53
P 63
(J2) P162
(J10) P160
P 58
P 52
P 50
P161 (J5)
P159 (J6)
P148 (J1)
W119

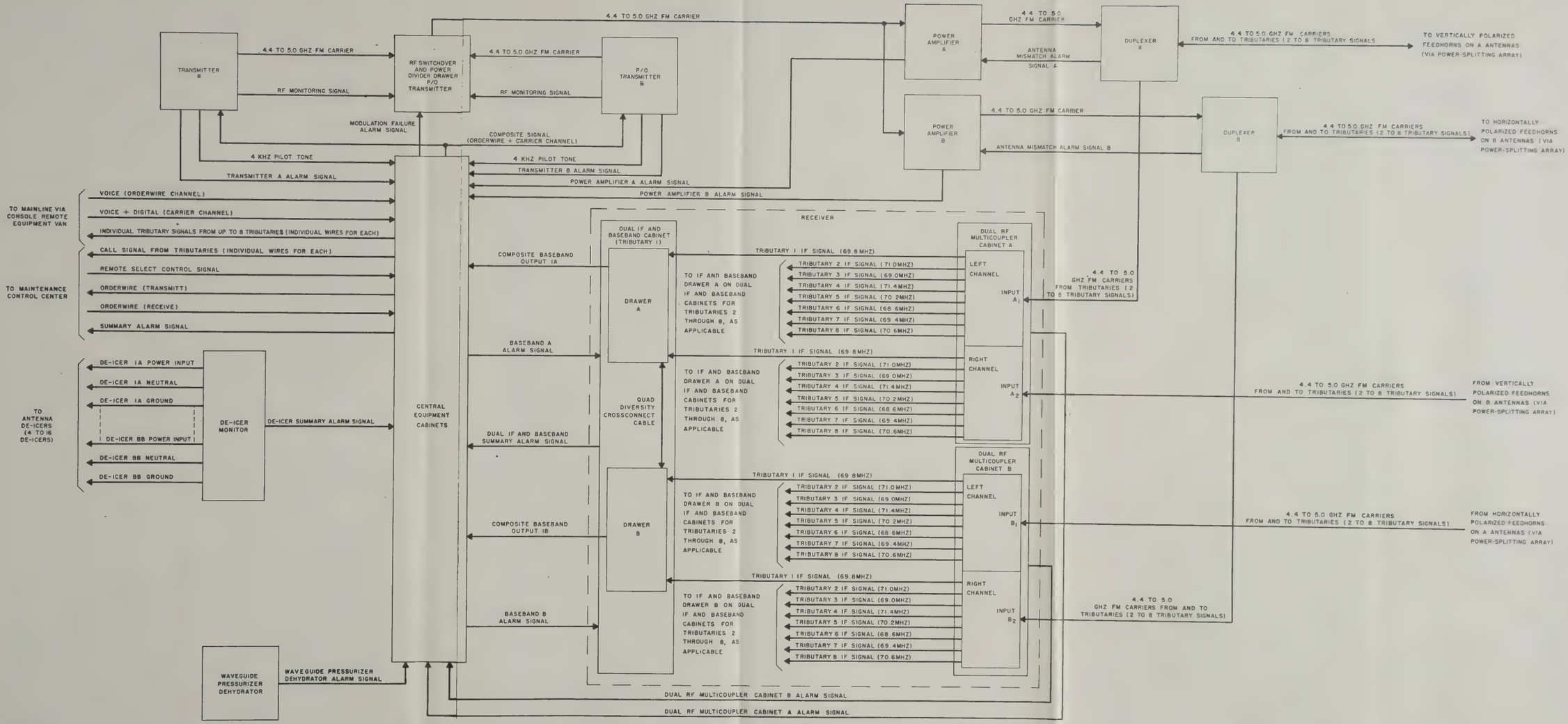


Figure 6-3. 1-kw nodal point radio set, block diagram.

TM5820-758-15-5

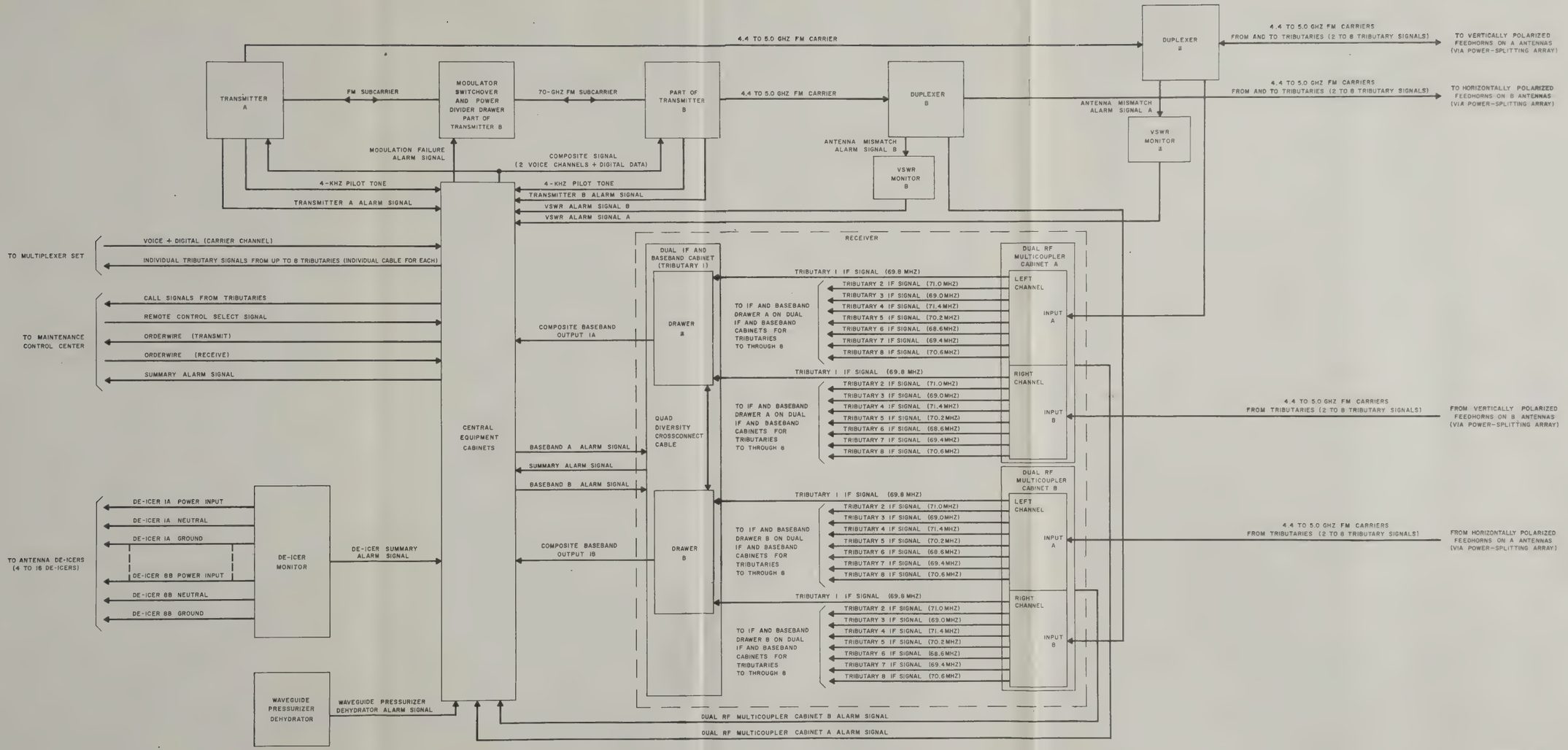


Figure 6-4. 1-watt nodal point radio set, block diagram.

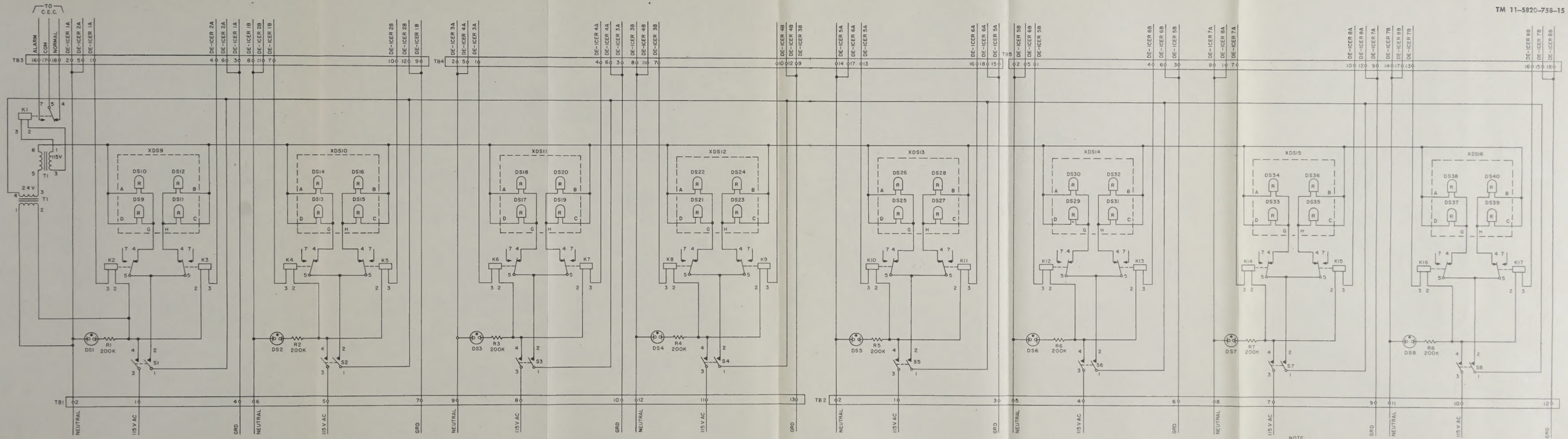


Figure 6-5. Deicer monitor, schematic diagram.

NOTE:
UNLESS OTHERWISE SPECIFIED
ALL RESISTANCE VALUES ARE IN OHMS.

TM5820-758-15-8